The International Military Digest

Annual

1917

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Annual

A Review of The Current Literature of Military Science

for 1917

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Table of Periodical Title Abbreviations

Recent issues of the following periodicals have been digested, in whole or in part, for this issue of the INTERNATIONAL MILITARY DIGEST. *Practically the entire contents of the distinctively military periodicals are digested. From the popular or general periodicals (designated in this list by an asterisk [*]) only articles on military topics or of military significance are digested.*

Abbreviated Reference Title.	Full Title and Address.
*Aerial Age**	Aerial Age. Weekly. 280 Madison ave., New York City.
*Aeronautics**	Aeronautics. Monthly. 250 W. 54th street, New York City.
Armée Zeitung	Armée Zeitung. Weekly. L. W. Seidel und Sohn. Graben, 13, Vienna.
Arms & Explosives	Arms and Explosives. Monthly. Arundel st., Strand, London, W. C.
Arms and the Man	Arms and the Man. Weekly. 1502 H street, N. W., Washington, D. C., U. S. A.
Army & Navy Gazette	Army and Navy Gazette. Weekly. 22 Essex street, Strand, W. C., London.
Army & Navy Jour.	Army and Navy Journal. Weekly. 20 Vesey st., New York City.
Army and Navy News	Army and Navy News. Monthly. San Francisco, California.
Army & Navy Register	Army and Navy Register. Weekly. 511 Eleventh st., Washington, D. C.
Artill. Monatshefte	Artilleristische Monatshefte. Monthly. Mohrenstr. 19, Berlin, W. 8.
Artilleri Tidskrift	Artilleri Tidsakrift. Bi-monthly. Almquist and Wiksello Boktryckeri A. B., Upsala, Sweden.
*Atlantic Monthly**	Atlantic Monthly. Monthly. Atlantic Monthly Co., Boston.
Australian Mil. Jour.	Australian Military Journal. Quarterly. Victoria Barracks, Melbourne, Australia.
*Aviation**	Aviation and Aeronautical Engineering. Semi-monthly. 120 W. 32d street, New York City.
Boletim Mensal	Boletim Mensal do Estado Maior do Exercito. Monthly. Imprensa Militar. Rio Janeiro, Brazil.
Boletin de Guerra	Boletin del Ministerio de Guerra y Marina de Perú. Fortnightly. Apartado de Correo No. 91, Lima, Peru.
Canadian Military Gazette	Canadian Military Gazette. Semi-monthly. Room 16, Trust Bldg., Ottawa, Canada.
*Century**	Century Magazine. Monthly. 353 Fourth ave., New York City.
Commercial Vehicle, The	The Commercial Vehicle. Bi-monthly. 239 W. 39th st., New York City.
*Contemporary Review**	Contemporary Review. Monthly. London. 7 Warren st., New York, Leonard Scott.
Dansk Artilleri Tidsskrift	Dansk Artilleri Tidsskrift. Monthly. Herluf Trollesgade, 23, Copenhagen, Denmark.
Dansk Militaert Tidsskrift	Dansk Militaert Tidsskrift. Bi-weekly. Rosenvaegets Alle 14, Copenhagen, O.
Die Verteidigung	Die Verteidigung. Monthly. Pera Zumbulstrasse No. 12, Constantinople, Turkey.
Field Artillery Jour.	The Field Artillery Journal. Quarterly. U. S. Field Artillery Association, 1701 Pennsylvania ave., Washington, D. C.
*Flying**	Flying. The Flying Association, Inc. 280 Madison ave., New York City.
*Fortnightly Review**	Fortnightly Review. Monthly. London, 7 Warren st., New York. Leonard Scott.
Guerra y Su Preparación	La Guerra y Su Preparación. Monthly. Madrid. Tallero del Depósito de la Guerra.
Heiji Zasshi	Heiji Zasshi. Monthly. Tokio.
*Independent**	The Independent. Weekly. 130 Fulton st., New York City.
Indisch Militar Tydschrift	Indisch Militar Tydschrift. Monthly. G. Kolff & Co., Batavia, Weltervreden, Java.
Infantry Jour.	Infantry Journal. Bi-monthly. U. S. Infantry Association, 814 Seventeenth st., Washington, D. C.
Jahrbücher, Deutsche A. u. M.	Jahrbücher für die deutsche Armee u. Marine. Monthly. Verlag Georg Bath, Bernburgerstrasse, 24-25, Berlin, Germany.
*Jour. Aeronautical Soc.**	Journal of the Aeronautical Society of America. Monthly. New York, N. Y.

*Jour. Amer. Medical Assn.**	Journal of the American Medical Association. Weekly. American Medical Association, 535 North Dearborn st., Chicago, Ill.
*Jour. Franklin Inst.**	Journal of the Franklin Institute. Monthly. Philadelphia, Pa.
Jour. Military Service Inst. U. S.	Journal of the Military Service Institution. Bi-monthly. Governor's Island, N. Y.
*Jour. Political Econ.**	The Journal of Political Economy. Monthly. University of Chicago Press, Chicago, Ill.
Jour. Royal Army Medical Corps	Journal of the Royal Army Medical Corps. Monthly. John Bale Sons, 83 Great Titchfield st., London, W.
Jour. Royal Artillery	The Journal of the Royal Artillery. Monthly. Woolwich, England.
Journal R. U. S. Institution	Journal of the Royal United Service Institution. Quarterly. Royal United Service Institution, Whitehall, London, S. W.
Jour. U. S. Artill.	Journal of the United States Artillery. Bi-monthly. Fort Monroe, Va.
Jour. United Service Inst. India	Journal of the United Service Institution of India. Quarterly. Simla, India.
Abbreviated Reference Title.	**Full Title and Address.**
Jour. U. S. Cavalry Assn.	Journal of the United States Cavalry Association. Bi-monthly. Fort Leavenworth, Kans., U. S. A.
Kaikosha Kiji	Kaikosha Kiji. Monthly. Tokyo, Japan.
Kriegstechnische Zeitschrift	Kriegstechnische Zeitschrift. 10 numbers per year. E. S. Mittler & Sohn. König. Hofbuchhandlung, Kochstrasse, 68, Berlin, Germany.
Krigsvetenskaps Akadamiens Tidskrift	Krigsvetenskaps-Akadamien Handlingar och Tidskrift, (Proceedings of the War Institute). Published irregularly after meetings. P. A. Norstedt & Söner, Stockholm, Sweden.
Marine Corps Gazette	The Marine Corps Gazette. Quarterly. 24 E. 23d st., New York City.
Marines Magazine.	The Marines Magazine. Monthly. 1734 New York ave., N. W., Washington, D.C.
Memorial de Artilleria	Memorial de Artilleria. Monthly. Museo de Artilleria, Madrid.
Memorial del Ejército de Chile	Memorial del Estado Mayor del Ejército de Chili. Monthly. Talleres del Estado Mayor General, Santiago, Chili.
Memorial del Estado Mayor de Colombia	Memorial del Estado Mayor del Ejército de Colombia. Bi-monthly. Estado Mayor General, Begotá, Colombia.
Mem. de Infanteria	Memorial de Infanteria. Monthly. Ministry of War, Madrid, Spain.
Memorial de Ingenieros	Memorial de Ingenieros del Ejército. Monthly. Calle de los Martires de Alcalá, Madrid.
Militaire Spectator	Militaire Spectator. Monthly. A. W. Bruma u Zn., Utrecht, Holland.
*Mil. Hist. and Econ.**	The Military Historian and Economist. Quarterly. Harvard University Press, Cambridge, Mass.
Military Surgeon	The Military Surgeon. Monthly. 7th and B. streets, Washington, D. C.
Mitteilungen des Artillerie u. Geniewesens	Mitteilungen über Gegenstände des Artillerie und Geniewesens. Monthly. Getreidemarkt 9, Vienna, VI.
Modern Hospital	The Modern Hospital. Monthly. The Modern Hospital Publishing Co., Metropolitan Building, St. Louis, Mo.
National Guard Mag.	The National Guard Magazine. Monthly. 136 E. Gay st., Columbus, O.
Norsk Artilleri Tidsskrift	Norsk Artilleri Tidsskrift. Monthly. Christiania.
Norsk Militaert Tidsskrift	Norsk Militaert Tidsskrift. Monthly. Christiania.
Nuova Rivista di Fanteria	Nuova Rivista di Fanteria. Monthly. Via Viminale, 58, Rome.
Organ der Krijgswetenschap	Organ der Vereeniging ter Beœfening van der Krijgswetenschap. Monthly. C. Blommendaal, 's-Gravenhage, Holland.
*Outlook**	The Outlook. Weekly. 381 Fourth ave., New York City.
*Popular Science**	Popular Science Monthly. Monthly.
Proceedings Naval Institute	Proceedings of the Naval Institute. Bi-monthly. Annapolis, Md., U. S. A.
Professional Memoirs	Professional Memoirs of the Corps of Engineers. Bi-monthly. Washington Barracks, D. C., U. S. A.
Railway Age Gazette	Railway Age Gazette. Weekly. Simmons-Boardman Publishing Co., Woolworth Building, New York City.

*Review of Reviews**	The Review of Reviews. Monthly. 30 Irving Place, New York City.
Revista de Artilharia	Revista de Artilharia. Monthly. Rua do Carmo, 48 2° Direito, Lisbon.
Rev. del. Circulo Militar	Revista del Circulo Militar. Monthly. Maipú 255, Buenos Aires, Argentina.
Revista Militar (Argentina)	Revista Militar. Monthly Ministerio de Guerra, Santa Fe, 1461, Buenos Aires, Argentina.
*Revue des Deux Mondes**	Revue des Deux Mondes. Semi-monthly. 15 Rue de l'universitié, Paris.
Rivista di Artiglieria e Genio	Rivista di Artiglieria e Genio. Monthly. Tipografia Enrico Voghera, Via Astalli 15, Rome.
Rivista di Cavalleria	Rivista di Cavalleria. Monthly. Scuola di Applicazione di Cavalleria. Pinerola, Italy.
Riv. Mil. Italiana	Rivista Militare Italiana. Monthly. Rome, Italy.
Royal Engineers Jour.	The Royal Engineers' Journal. Monthly. Chatham, England.
Schweiz. Zeitschrift f. Art. u. Genie	Schweizerische Zeitschrift für Artillerie und Genie. Monthly. Verlag von Huber & Co. Frauenfeld, Switzerland.
*Scientific American**	Scientific American. Weekly. 361 Broadway, New York City.
*Scribner's**	Scribner's Magazine. Monthly. 597 Fifth ave., New York City
*Sphere**	The Sphere. Weekly. Great New st., London, E. C.
Svensk Intendentur Tidskrift	Svensk Intendentur Tidskrift. Monthly. Frederikshaf, Stockholm 14, Sweden.
Svensk Kustartilleritidskrift	Svensk Kustartilleritidskrift. Quarterly. A. B. Amiralitets & Stadsboktryckeriet, Karlskrona, Sweden.
Tidskrift i Fortifikation	Tidskrift i Fortifikation. Monthly. Kungl. Boktryckeriet, P. A. Norstedt & Söner, Stockholm, Sweden.
United Service Mag.	United Service Magazine. Monthly. 31 Haymarket, London, S. W.

International Military Digest Annual

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A REVIEW OF THE CURRENT LITERATURE OF MILITARY SCIENCE

Main entries are indicated by **BLACKFACE CAPS;** subheads by **lower case blackface;** geographical subdivisions by *italic* center heads.

NOTE.—*The digests of articles presented herein are merely condensed statements of the original articles-. The Editors assume no responsibility for the opinions or conclusions, which are those of the individual authors. Any editorial comment is enclosed in brackets* [].

ABYSSINIA

—Army

[The Ethiopian Army. By Gillo. *Riv. Mil. Italiana,* Sept, '16. 5000 words.]

The Abyssinian army probably had on the battlefield of Adua 60,000 rifles, of small or mediocre value. After that battle large acquisitions of weapons were made, almost all of them breech-loading, and not a few magazine rifles of the best models. In round numbers, Ethiopia can now place in the field 300,000 combatants, 275,000 armed with guns of various calibers and about 25,000 armed with lance or saber. The cavalry usually has the pistol, revolver or carbine. In addition, the army has about 60 pieces of light artillery and a dozen machine guns, which are rather an incumbrance than a help, due to ignorance and inexperience in their use. All the weapons are scantily supplied with ammunition and re-supply is difficult on account of the number of different calibers in use.

The good qualities of the Ethiopian soldier are well known. The people are warlike by instinct. They make excellent cavalry and the swiftest infantry in the world, but the worst armed.

General Mobilization. When the Emperor wishes to assemble the army he sends a proclamation to every part of the country, where it is read to the sound of the drum. Each chief of a province gathers his men and joins the chief of the region, who proceeds to the designated point of assembly or waits and joins the army as it passes thru his section.

Order of March. In the vicinity of the enemy the order of march is: first, infantry armed with the rifle; second, infantry armed with the lance and saber; and third, cavalry, at the head of which is the chief commanding the contingent. The artillery follows the cavalry. The Emperor is accompanied by an elaborate retinue of guards, musicians, staff, priests, and other dignitaries. At the rear of the column is a motley array of servants and families of the combatants.

Halts. The first thing done at a halt for the night is to pitch the Emperor's tent. The various subdivisions of the army group themselves to the right and left of this tent according to immutable rules of precedence. The impedimenta take post in rear of the army.

Service of Security. A very effective service of security is performed by the foraging parties that scour every part of the country near the army. At night the advance guard provides security in front and the various units guard the flanks. Considering the highly developed senses of sight and hearing among the Abyssinians, the service of security is poorly performed, especially in camp.

Rations. The army lives on the country. This practice leads to many conflicts between the foraging parties and the populace. The armed forces maintained in time of peace are supported by the rest of the inhabitants in accordance with ancient custom.

Combat. The deployment is made with astonishing rapidity, due not only to individual quickness of movement, but also to the fact that each unit always has a fixed place in the line of battle according to its precedence. The center is formed of troops directly under the Emperor; the right and left wings are made up of other forces. The cavalry menaces the flanks and

ABYSSINIA—Continued

rear of the enemy and enters vehemently into action at the moment of victory.

Attack. The attack is initiated by a line of skirmishers, advancing by rushes and firing from cover. They are followed rapidly by the main body, and at a short distance from the enemy the two lines merge into one which rushes upon the enemy for the hand-to-hand conflict with the scimitar. Victory is followed by plunder and often by the killing and mutilation of wounded and prisoners.

Considering the Abyssinian as a possible enemy, the points to be kept in mind are the organization of native troops from tribes hostile to him, the opportunities for attack offered by his poor security service, his uncertain means of subsistence, and his numerical superiority. The proper method of opposing him appears to be a combination of the strategical offensive with the tactical defensive.

ACCIDENTS

See also

MUNITION—MANUFACTURE OF—ACCIDENTS

ACCOUNTING, Military

See also

ADMINISTRATION, MILITARY—ACCOUNTING AND PAY DEPARTMENT

ADMINISTRATION, Military

See also

AERONAUTICS—ORGANIZATION AND ADMINISTRATION

COMPANY—ADMINISTRATION OF

VETERINARY SERVICE—ORGANIZATION AND ADMINISTRATION

[Responsibility in the Army. *Army & Navy Gazette,* Jan 13, '17. 250 words.]

In a pamphlet under the above title, Lt.-Gen. Sir A. Codington insists that when an officer is made responsible for certain duties he should be told to whom he is thus responsible, so that the chain of responsibility should be made clear, and the superior put in the position of being concerned in the fulfillment, by his subordinate, of the duties laid upon that subordinate. He points out that a commander must neither do all the work himself nor leave it to a subordinate of whose reliability he has no knowledge. Where the chain of responsibility is vaguely defined, the wrong person, usually a subordinate, is likely to receive blame for mistakes.

[The Central Depot of the Army in Florence. By Col. D. Javier de Manzanos. *La Guerra y su Preparación,* Mar, '17. 1350 words.]

This is the connecting link between the theater of operations and the zone of the interior. Thru it passes all the matériel destined for the army in the field and also the matériel sent from the front for repairs. The depot is under the control of a director general, who has under his control a captain-secretary and a number of correspondence clerks, and who also makes use of the personnel of the partial depots of the different services. Each partial depot is under charge of a director, who is a colonel or lieutenant-colonel of the arm of the service to which the depot corresponds. Among the partial depots are the following:

The depot of sanitary matériel comprises 21 warehouses in different parts of the city and one outside for inflammable material. All sanitary supplies are received in the central pharmacy and there classified and distributed to the warehouses. The director is a medical officer and he has under his control the necessary personnel.

The subsistence depot is under the direction of the military governor-general, who has under his control 350 men. There are 20 warehouses. Associated with this depot there is a private factory of canned food, which works exclusively for the army, and which prepares canned meat not only for the reserve ration but to alternate with the daily ration of fresh meat. At present on account of the expected scarcity of beef, pork is much used for this purpose, in the form of a mixture of hash and bacon, which, well seasoned, makes an agreeable paste.

The depot of clothing and equipment is directed by a lieutenant-colonel of the Commissary Department of reserve militia, who has fifty men under him. The depot stores make clothing and a great quantity of pieces of cloth. This cloth is turned over to the municipality, which distributes it among the tailors and costumers, who manufacture clothing, returning the same, together with the scraps, to the depot. The scraps are sold.

The depot of artillery matériel is under the command of the artillery commander of the fortress. He has under him 300 men. In this depot projectiles of the smaller calibers are loaded, and powder bags are made. A brown American powder is used, with a little black powder to accelerate its action. The depot also makes repairs in artillery matériel, relines guns, etc.

The depot of engineer matériel is under the chief of engineers of the fortress. The personnel consists of thirty men. No work is done in this depot.

United States

See also

AERONAUTICS—ORGANIZATION AND ADMINISTRATION—UNITED STATES

—Accounting and Pay Department

[Property Accountability. By Lieut.-Col. Mark L. Hersey, 24th Inf. *Infantry Jour.,* June, '17. 1500 words.]

Recognizing the need for a revision of our system of property accountability in the Quartermaster's Corps, General Pershing, in January, appointed a board of three officers, who, looking to the reduction of paper work and simplification of the accounting system, submitted thirteen recommendations, in brief, as follows:

1. An Equipment Manual which tells what is required in each organization.

2. A Supply Manual which tells how to get the equipment required.

3. Make the regimental commander directly responsible for the proper equipping of his regiment and the expenditures connected therewith. His approval of a requisition to be the depot's receipt for the property, for which he becomes responsible. No further returns are necessary. His decision as to disposition of any article is final, and worn out articles are destroyed by him and so noted in the regimental supply officer's property record.

4. Make regimental supply officers accountable for all non-expendable articles of field equipment, in all the supply departments, and have only one ordnance return for each regiment.

5. Issue all field equipment on the requisition of the supply officer of the organization, approved by the commanding officer.

6. Use the same blank form for requisition, invoice, receipt and memorandum receipt. Requisitions to be submitted in triplicate one of which the depot quartermaster signs and returns as an invoice. He keeps one copy and forwards one to the quartermaster general.

7. Have property records kept with the supply company which also makes out payrolls for the regiment, leaving in the hands of fighting organizations only memorandum receipts for property, and the equipment and account records of each man. Changes affecting a soldier's pay status to be forwarded immediately to the supply officer.

8. When a man enlists or re-enlists, credit him with his initial clothing allowance on the next pay roll, and thereafter, each month, one-twelfth of his annual allowance. Charge on the pay rolls all clothing drawn and pay the soldier the difference, or deduct from his pay if he overdraws. The pay roll thus becomes both a property and money voucher, affording a perfect audit for our clothing.

9. Pay commutation of rations on pay rolls.

10. Require no returns from the regimental supply officer. His property account, subject to inspection at all times, will safeguard the interests of the government.

11. Keep records of animals on a sheet of paper with properly headed columns, giving only one line to each animal.

12. Place an emergency fund of about $1000 to the credit of each regimental supply officer for purchase of supplies in campaign and in emergencies, in peace times. Statements of money expended to be rendered to nearest chief quartermaster who immediately replenishes the fund.

13. Pay officers by checks and abolish the present system of pay accounts.

These recommendations are simple and workable; they reduce paper work and hence the expense; they safeguard the interests of the government better; and are equally applicable in garrison, and to all supply departments.

—War Departments and Ministries

[The New Ministries in France and Their Relations with the Ministry of War. By Col. D. Juan García Benítez. *La Guerra y su Preparación,* Mar, '17. 1500 words.]

The Minister of Armaments and of War Manufactures has charge of seeking, organizing, and setting in motion all the forces necessary for the preparation, production and utilization of war munitions. He buys, constructs and stores the material formerly under the charge of the sub-secretary of war. By agreement with the Minister of War he prepares the programs of armament. He controls the technical employment of munitions. He divides among the divers services the raw materials, the means of construction and the force of laborers. With a few exceptions he has control of the purchase of raw materials. There have been transferred to him the powers of control of inventions, and of the hydraulic forces of non-navigable streams formerly intrusted to the ministry of public instruction and the ministry of agriculture respectively. The Minister of War places at his disposal the necessary military personnel for the fulfillment of the duties of this department and he has full power to assign them to duty, to transfer them and to punish them, except in so far as he is limited by the code of military justice. Promotions in the artillery and in the train corps are agreed upon by him and the Minister of War.

The Minister of Public Works, Transportation and Provisions is charged with the provisioning of the army up to the point where the supplies are turned over to the armies in the field. He also has the duty of enforcing the laws concerning the provisioning of the civil population and the requisitioning of supplies. For this purpose he has control of and with the consent of the Minister of War regulates promotions in the personnel charged with this service.

The Sub-secretary of State charged with general administration in the Ministry of War, directs, in the name of the Minister, the administration of the army, except in questions concerning the service of military sanitation, which are under the direction of the Sub-secretary of State in the service of military sanitation.

The Sub-secretary of State in the service of transportation controls the rail and water transportation. He gives priority over all other classes of transportation to the movements of troops and of war material and to the evacuation of the wounded. In the theater of operations his functions are exercised by the director of the rear-guard services.

ADVANCE GUARD

See also
PATROLS

AERIAL ARTILLERY

See also
ANTI-AIRCRAFT ARTILLERY

Germany

[Non-Recoil Airplane Guns. *Rivista di Artiglieria e Genio,* Jan, Feb, Mar, '17. 60 words.]

The Germans have lately invented a non-recoil type of gun. The smallest of these guns has a caliber of 1.12 inches, is about 10 feet long, weighs about

AERIAL ARTILLERY—Continued

72 pounds and throws a projectile weighing about 900 grams. The largest gun of this class has a caliber of 3 inches, weighs 190 pounds and throws a projectile weighing 11 pounds to a distance of 8 to 9.5 miles.

AERIAL TORPEDOES

See

TORPEDOES—AERIAL

AERIAL WARFARE

See

AERONAUTICS

AERO ARROWS

See

"FLECHETTES"

AERODYNAMICS

See

AERONAUTICS—THEORY OF

AERONAUTICS

See also

AERIAL ARTILLERY
ALBATROS AIRPLANE
ALUMINUM (Article: "Aluminum in Modern Automobile and Aviation Construction.")
ANTI-AIRCRAFT ARTILLERY
ARTILLERY—FIRE CONTROL—AERONAUTIC
AVIATIK AIRPLANE
BALLOONS
CAPRONI TRIPLANE
CURTISS AEROPLANES
DIRIGIBLES
FIELD ARTILLERY—FIRE CONTROL—AERONAUTICS
"FLECHETTES"
GOTHA BATTLE PLANE
GOTHA BIPLANE
HANDLEY PAGE GIANT BIPLANE
HANGARS
HYDROAIRPLANES
KITE BALLOONS
KITES
NIEUPORT AIRPLANE
POSTAL SERVICE, MILITARY—USE OF AIRPLANES IN
RAIDS—AERONAUTIC
RECONNAISSANCE
SPAD AIRPLANE
TACTICS (Article: "Modern Battle Tactics")
TORPEDOES—AERIAL
TORPEDOPLANES

[Military Aviation. By the War College Division, General Staff Corps. *Jour. Military Service Institution,* Sept-Oct, '16. 4500 words.]

The presence of aircraft on our coast and with our mobile forces has become a necessity. The relation of this branch of the service to other arms of the army and navy is a subject now in discussion in all countries. The use of aircraft at oversea stations, the use of captive and dirigible aircraft and aeroplanes is discussed, especially the organization of the aeroplane squadrons, as to the number and type of machines and the special purpose of each. Among other subjects touched on are: Aeroplane engines; height at which aeroplanes fly; strategical reconnaissance; photography from aeroplanes; aeroplanes and artillery combat of the air; surprise movements; bomb dropping; tactics of aeroplanes; development during the European War; personnel; losses; development in the United States; scope and need of legislation.

[The News of the Week. *Flying,* Oct, '16, 4000 words.]

A Curtiss tractor biplane just completed and designed as a Zeppelin destroyer, in its recent tests performed as follows: high speed 120 miles per hour; low speed, 45 miles per hour; climbed 10,000 ft. in ten minutes.

The Sturtevant aeroplane designed for the U. S. Army in its recent tests, rose 2600 ft. in 10 minutes, made a speed of 75 miles per hour. During the tests the weight of machine, passengers, gas and oil was 2500 lbs.

By changing the firing order, intake manifold water, jacketing the carburetor, and making several other changes, the Curtiss type VX motor which used to develop 160 h.p. now develops 190 h.p. and runs much smoother. On account of propeller trouble with this motor at the border, the hub of the propeller has been changed and strengthened.

The Aero Club of America has issued 594 pilot certificates, 52 hydroaeroplane pilot certificates and 57 expert aviator certificates.

The installation of wireless on the Zeppelins makes use of the metal framework for the capacity ground and a trailer wire for aerial. The aerial wire is ordinarily lowered after the oscillating circuit of the transformer has been adjusted to the desired wave length. By watching the deflection of the hot wire ammeter, the operator can determine when sufficient wire has been paid out to obtain a radiating system of a natural wave length the same as that of the oscillating circuit. The best results are secured when the maximum deflection is noted on the hot wire ammeter.

[The News of the Week. *Aerial Age Weekly,* Oct 23, '16. 1100 words.]

An enormous flying boat made a flight on Lake Keuka on Oct 16, with eleven passengers besides the pilot. It is a pusher type with two 200 h.p. Curtiss motors.

The Navy Department has just ordered six Sturtevant aeroplanes complete.

Aeroplane mail service is maintained between the headquarters of the American troops in Mexico and Columbus, N. M., a distance of 120 miles. The time required is 66 minutes. Four days was formerly required by wagon.

Aeroplane tests with the Hammond wireless controlled torpedo will be conducted at Gloucester, Mass., in November.

[A Method of Aligning Single-Engine Tractor Biplanes. By B. Q. Jones, U.S.A. *Aviation,* Jan 1, '17. 1500 words.]

(This article is a technical article giving the methods of aligning an airplane while assembling it, in order to prepare it for flight. It includes alignment of the landing gear, center sections, leading edge, dihedral, trailing edge, droop, tightening and safetying of wires, length of struts, positions of fittings, warp in planes, alignment of ailerons, stabilizer, elevator flaps and rudder.)

[Airplanes for 1917. *Aviation,* Feb 1, '17. 3000 words. Illustrated.]

(This article gives the characteristics and performances of the machines made by the Aeromarine and Motor Co., the American Aircraft Co., the Benoist Airplane Co., the Burgess Co., the Curtiss Aeroplane and Motor Co., the L. W. F. Engineering Co., the Standard Aero Corporation, the Sturtevant Aeroplane Co., and the Wright-Martins Co.)

[Military Aviation. A Study Prepared in the War College Division General Staff. *Aerial Age Weekly,* Feb 5, '17. 4848 words.]

Aviation may be regarded as embracing all aerial appliances, such as heavier-than-air craft, dirigibles, lighter-than-air craft, and captive balloons, with the personnel necessary for their operation and management. The defensive formations of the army consist of the harbor defenses and accessories and mobile units. The harbor defenses consist of fixed and mobile gun defenses and mine defenses. The aircraft required in connection with the harbor defenses consist of machines to be used for:

1. Reconnaissance, that is, to determine the strength, dispositions and probable intentions of the enemy.
2. For preventing hostile aerial reconnaissance.
3. For destroying hostile aircraft and other offensive purposes against submarines and mine layers.
4. For aiding in spotting the fire of coast artillery.

The number and character of the aircraft required depends on the local conditions and topography. The number of airplanes for each mobile division is fixed at one squadron of twelve airplanes. The airplanes in use in Hawaii, the Philippines and the Canal Zone would be mostly hydroairplanes so that they can be used for reconnaissance over water.

Captive balloons are used to observe such things as cannot be seen from the ground, principally for observation and reporting on the effects of artillery fire. This is done by telephone or telegraph. In clear weather, with good glasses, the field of observation from a captive balloon is about 20,000 yards. All captive balloons now have an undersurface that acts like a kite, thus keeping the balloon steady in a strong wind. An organization of 4 officers and 72 men is required to handle a captive balloon.

Dirigibles are lighter-than-air craft that have engines and propellers which can move them from place to place. They are divided into the non-rigid which have no framework, the semi-rigid which have a framework to help the envelope keep its shape, and the rigid which have a framework for the whole envelope. Of these three types the rigid is the most successful; the semi-rigid are used quite frequently and the non-rigid used not at all. The most efficient dirigible used is about 485 feet long, has a gas capacity of about 900,000 cu. ft., a total lift of 20 tons and a useful lift of about 5 tons. They have a speed of from 50 to 60 miles per hour, and a fuel capacity for over 4 days' run. Crews of from 10 to 20 men are required to operate them. They are equipped with light guns, searchlights, bomb-dropping devices and very efficient radio outfits.

The principal types of airplanes are: pursuit or combat machines, reconnaissance airplanes and battle machines. The pursuit machines are used for fast reconnaissance and combating enemy's aircraft, the reconnaissance for ordinary reconnoitering work and for observation of artillery fire and the battle machines for destruction of enemy's material, personnel or equipment. Due to the anti-aircraft guns, it is now necessary for airplanes to fly at altitudes of 6000 feet or over. From this height large columns of troops, trains, railways, bridges, artillery firing and defensive positions can usually be distinguished. Thus it is now said that strategical reconnaissance is carried on by airplanes and tactical reconnaissance by troops or captive balloons. The observer in aircraft is always a trained one so that he can interpret the military features that he sees. By taking a single photograph or a series of photographs, details of the ground discovered are entered on the maps. Airplanes also pick up targets for the artillery, and by signals, radio or otherwise, direct the fire of the batteries until the target is put out of action.

In order to obtain control of the air a series of combats of airplane against airplane takes place, and the side having the greater number usually gains the control of the air. The side having complete control of the air has greater opportunities of completely surprising the enemy than ever before on account of being able to locate the masses of his troops.

Bombs varying in weight from 15 to 50 lbs. have been dropped by airplanes. In order to drop them with any chance of hitting the target, the height, speed and wind must be considered. Up to the present time no great results have been obtained. For bomb-dropping enterprises 30 to 60 machines loaded with 5 to 10 bombs each start out for the locality against which they are operating. They circle until all the bombs are dropped and then return.

In the practical use of airplanes, the speed machines reconnoiter to the front followed by the battle planes, which in turn clear a way for the reconnaissance planes.. The squadron is the tactical and administrative unit. It has a personnel consisting of pilots, observers, bomb-droppers, mechanicians, chauffeurs and drivers. In general an airplane requires for its operation a personnel of 1 pilot, 1 observer and 2 enlisted men. As the work of the airplanes increased abroad the number was increased, until now the aviation service is a separate corps. The observers are trained staff officers or officers belonging to the corps. The losses to the flying personnel in war seem to be less than that of infantry, cavalry and artillery in the order named.

AERONAUTICS—Continued

Germany

[Germany's Aerial Champions. Note. *Scientific American,* Nov 18, '16. 100 words.]

The German War Office announces its ten most successful aviators with number of hostile machines brought down as follows Capt. Boelke, 19; Lieut. Immelman (dead), 15; Lieut. Wintgens, 11; Lieut. Hoehndorf, 10; Lieut. Parchan (dead), 8; Lieut. Mulzer, 8; Lieut. Baron von Althaus, 8; Lieut. Liffers, 5; Lieut. Walz, 4; Lieut. Gerlich, 4. The figures are to the end of July. Capt. Boelke has since been killed after having brought down nearly 30 hostile machines.

[Aviation Notes. *Army & Navy Jour.,* Feb 3, '17. 70 words.]

The Germans have asserted that they lost only 221 airplanes in 1916. A French semi-official statement in reply says that 417 German machines were shot down by aviators; that 195 other machines were brought down after bad injuries; and that 29 captive balloons were blown up.

[New Type German Aeroplanes. *Aviation,* Feb 15, '17. 530 words.]

Realizing the importance of great speed in deciding air battles, the Germans have produced many new types of pursuit machines. The Halberstadt, Roland, German Spad and New Fokker are the best types of these new machines. They all have a span of about 30 ft., a length of about 20 ft. and engines of from 120 to 160 h.p. These airplanes all have machine guns which shoot thru the propeller from the upper side of the top plane. The New Fokker instead of using ailerons, warps its wings for lateral stability.

Great Britain

[Aeronautical Notes. *Scientific American,* Dec 16, '16. 100 words.]

The 1916 British expenditures for aeronautics are reported to be close to $250,000,000, and it is said that the British have spent more for aeroplanes and aeronautic engines in the United States than the United States government has so far expended. The expenditure, in view of British unpreparedness in aerial defences, is well worth while.

[Importance Attached to Air Fleet by British. *Scientific American,* Jan 13, '17. 100 words.]

Lord Montague has recently stated that because the English must rely upon air service to defend one-half of the 2000 miles of coast line against invasion by airships, it must be the last arm to be reduced when peace comes, and that the cost of maintaining a permanent force of 20,000 airplanes would not exceed $75,000,000.

[New British Airplane Takes 21 Up a Mile. *N. Y. Times,* Feb 21, '17. Quoted.]

The *Aeroplane* says a newly designed giant airplane, in a test trip, has risen to an altitude of 7000 feet, carrying a pilot and twenty passengers.

This is the first news that the super-airplanes planned three months ago, have been successful. Ever since the "big push" last year, the British and French constructors have been developing larger and larger machines. Details of the most recent show that they have as high as 1000 horse-power, divided between four and sometimes two Rolls-Royce, water-cooled motors. The complete equipment of these giant planes calls for four and sometimes six machine guns, at least two of which are 3-inch. They will carry more than 1500 pounds of bombs and have a speed of between 85 and 100 miles an hour.

This is the first time that a single airplane has been reported as carrying 21 passengers. The giant Sikorsky airplanes, built by the Russians, have carried 10 and 12, and the Super-America type of hydro-airplane, built by the Curtiss Aeroplane and Motor Company here, have flown successfully with the same number.

[The work of the Royal Naval Air Service. By G. H. D. *Sphere,* Mar 10, '17. 1000 words. Illustrated.]

Seaplane flying is still in its infancy. The work is far different from land flying, requiring special machines and special training. We are continuously experimenting with large seaplanes, and long oversea flights have been made. The most of this work has been done between the Austrians and Italians in the Adriatic.

One of the most important seaplane duties is that of coast patrol. New air stations have been established and no doubt in time there will be a continuous chain around the coast. Many patrols go far out to sea beyond sight of land, and these have done effective work against Zeppelins and submarines. Seaplane carriers are a necessary adjunct of the fleet. Specially designed ships must be built for this work. They must be speedy and roomy, with sufficient space for storage of machines, and a complete aeronautical workshop. A seaplane sent up from the carrier *Engadine* did excellent reconnaissance work in the Jutland fight.

The Royal Naval Air Service comprises both airplanes and seaplanes. The former are needed to combat raiding dirigibles and airplanes, but the seaward work requires the seaplane.

The seaplane and the dirigible are essential for observation work at sea. A seaplane at 5000 feet has a visible horizon of ninety miles.

[Britain's Bid for the Control of the Air. By Lieut. G. L. Faulkner, British Royal Flying Corps. *Scientific American,* Apr 28, '17. 2400 words.]

At the beginning of the war there were about 200 qualified aviators in Great Britain. Flying before the war was regarded in the light of a sport by the British; no practical military development was attempted. Great Britain's relative position was third in the development of aerial navigation as applied to warfare. Germany led and France came next; but Germany's preparation had been undertaken in the same measure and

with the same thoroness which characterized the organization of her other departments.

The following system of training for the thousands of aviators needed by Great Britain has been developed during the war:

After the pupil has learned to fly, he is sent to one of the colleges thruout the country that have been transformed into engine instruction schools. There he receives thoro training in all classes of rotary and stationary engines.

Next the pupil is sent to an aerial gunnery school, and there trained in shooting with a Lewis machine gun placed in a Vickers fighting gun-bus. The pupil must shoot at small balloons of about the size of a football, which are attached to the tail of another machine. Passing on to the aero bombing school, he is trained in the art of dropping bombs at moving and stationary objects on the ground.

Next comes the school of aircraft wireless, where the pupil learns to direct the fire of different types of guns from the air at a distance of 8 to 10 miles and at a height of 6000 feet.

The pilot is next taken to a stunt school, where he must fly in all kinds of weather and must master the various tricks such as the loop and sideslip, outside slip and the spinning nose dive.

After the pupil has acquired a thoro knowledge of flying, bombing, night flying, aerial gunnery, artillery observation, map reading, reconnaissance and topography, he is ready for service at the front.

The British and French have control of the air today on the Western front. Great Britain has already spent $650,000,000 on her air service, and it has been said that it is her intention to have one million men in the army and navy wings of the flying corps. Annually hundreds of millions of dollars will be spent in perfecting machines, aiding inventors and subsidizing plants that are manufacturing airplanes. The time is coming when wars will be settled in the air by great fleets of airplanes traveling at great heights.

[Progress in Aeronautics. By Major H. Bannerman Phillips. *United Service Magazine*, Apr, '17. 3200 words.]

The recommendations submitted by Mr. Bright in the final report of the Committee on the Administration and Command of the Royal Flying Corps are as follows: (1) Civilian Training Schools; (2) Advice from Active Service Pilots; (3) Inventions; (4) Inspectors (of War Aircraft and Aero-Engines); here he suggests the introduction into the Aeronautical Department of more men who have had a training which would especially fit them for the work in a technical sense, including a substantial knowledge of the materials involved. The pay and position at present do not offer sufficient inducement to attract applicants of the right caliber, and he points out that the men must be adequately paid; (5) Dating Inspection Stamps; (6) Standardization; in some industries this standardization is of great advantage, but nothing of close standardization can be applied to aviation in the present stage. If there is a commercial future for the heavier-than-air machine as a vehicle of transport the airplane will have grown out of all knowledge by the time it is required to be built in such numbers as to make standardization in the American sense advisable. Each type of machine should be specially designed to fulfill the particular purpose for which it is required, regard being had to the circumstances under which it is employed. He also suggests that there should be some definite standard time in air on which to base the weight for horse power, that standards should be adopted in the case of trials, and that a definite understanding ought to be formed between the aeronautical directorate and all those designing and supplying engines regarding the statement of horse-power. (7) Standard Heights of Speed and Climb, and Standard Time for Climb; he suggests that the speed specified should be (a) that practically at ground level, but also (b) that at the fairly average flying height of say 10,000 feet, where it may be less by five to two miles per hour. Similarly the climb should be expressed in miles per hour at the height of 10,000 feet; or if the machine is not capable of making that height, then the rate of climb in miles per hour should be stated for whatever the maximum height is. (8) Nomenclature; a system of nomenclature might be adopted to indicate the engine and horse-power which is combined with the machine itself. (9) Essential Extensive Development of Air Service; (10) Increased Output and Additional Factories; (11) Night Landing Grounds; (12) Lights for Night Landing Grounds; (13) Coast Patrols; (14) Offensive Raids; (15) Aircraft Committee; (16) Combination Between Air Services.

The official methods of testing airplanes have been moving steadily and practically in the direction of standardization during the progress of the war, partly because the condition at which an airplane has to fly in regard to height over country occupied by the enemy is much greater than in 1914. The test of an airplane's performances at a given height on two different days is not considered conclusive unless the density of the atmosphere was approximately the same on each occasion at that height. The power displayed by the engine, the resistance of the air to the passage of the machine and the lift on the wings are all three considerably affected by the density of the air at the time and height of the trial.

[Note. *Army & Navy Jour.*, May 12, '17. 185 words. Quoted.]

The new British airplanes of the type called "light fighters" and which are armed with rapid fire guns must make more than two miles a minute and operate at an altitude of more than five miles to meet the present requirements of war in Europe, according to Major L. W. V. Rees, a member of the British Flying Corps, who is with the British commission in Washington. Major Rees said the designs now being used for light fighters will be out of date in six months. The great thing is to get a new machine speedier and more efficient than the others. Control of the air has alternated back and forth as each new type has been

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developed, to be supplanted by a superior type. Respecting bomb dropping, Major Rees said it has been found necessary to descend very close to the target to make hits. Time fuses are used on the bombs to enable the machines to get safely away. The British airmen are at work continuously, directing gun fire. Germans do not use airplanes extensively to direct fire, but frequently use stationary balloons.

[Britain's Bid for the Control of the Air. The Airman's Duties at the Front and How He Executes Them. By Lieut. G. L. Faulkner, British Royal Flying Corps. *Scientific American*, June 2, '17. 2800 words. Illustrated.]

[This article gives a good general summary of the work of the air service and is quoted practically in full.—Ed.]

To maintain their aerial supremacy along the western front, the Entente armies employ huge flotillas of airplanes operating at a height of 6000 feet for one patrol and 20,000 or 23,000 feet for the other. The two patrols co-operate to prevent German machines from crossing the lines to obtain photographs and valuable information, for the general staff of an army can gain very little information regarding enemy movements, except thru the flying corps. Also, since the artillery must depend upon the air service for its sight, efficient artillery service depends upon the relative control of the air, and this fact accounts for the terrific struggles constantly taking place among the clouds between the rival air fleets.

"The bombing of enemy works and lines of communication is an important part of the air service's duties. Fifty or more machines will start out in the dead of night over the enemy's lines and penetrate 50 to 100 miles into enemy territory, bombing bridges, railroads, munition plants, aerodromes, and military works. The night patrols generally start at intervals; as a rule, ten minutes is allowed between every two machines. The staff commander takes the lead, and by firing a signal pistol which drops signal lights, the machines which follow know whether to turn to he right or to the left and when to drop their bombs. The pilots have their course set before starting, and can tell by the same system as that aboard a boat when a helmsman is running on a certain course for so many minutes, just at what point they happen to be. They know at what speed their machines travel and they know the distance from point to point and how long it should take them to cover that distance

"The Germans do not fancy night flying. They evidently believe in reserving their energy and machines for work during the day, and considering the large number of machines they have lost in artillery observation, this policy is undoubtedly well founded. The Germans concentrate on day work to a large extent, and depend to a greater degree than the Allies upon their anti-aircraft guns with which they are most skillful, often bringing machines down from a height of 10,000 feet to 12,000 feet. This class of artillery is handled by experts. The guns throw a ring of shrapnel around a hostile machine, and the pilot has to zigzag like a ship being chased by a submarine in order to avoid being hit. The Germans may fire as many as one hundred or two hundred rounds at a machine and still not cause sufficient damage to prevent the pilot from reaching his aerodrome. In fact, a machine subjected to this treatment is almost always hit, more or less; but it is surprising to learn the great number of times a machine can be hit without being seriously damages. Airmen often return with their machines riddled with holes from enemy anti-aircraft fire, yet they themselves are uninjured. However, it must not be inferred from this that Allied machines are never brought down by anti-aircraft fire, for the truth of the matter is that many of our machines are brought down and the majority of them in flames when the gasoline tanks are penetrated by shrapnel. Not a few of the occupants of such machines are burned to death before reaching the ground.

DAREDEVILS OF THE AIR AND THEIR FAVORITE TRICKS

"Both sides have had wonderful pilots, and among the foremost German pilots were the well-known Captain Boelke and Captain Immelmann, both deceased. These two pilots brought down a large number of British and French machines in the course of hundreds of engagements. Boelke was noted for his dive at an opponent from a great height. He would make an absolutely vertical nose-dive from a height sometimes of 15,000 to 20,000 feet, all the while making a speed around 150 miles an hour and firing at his opponent with a machine gun ejecting 600 shots a minute. At other times Boelke would come up behind an opponent and shoot into the tail and thru the machine in an attempt to disable the rudder, the observer, the pilot and the engine, all at one time. If he missed on the first dive he seldom came up again. This famous German pilot was noted for his quick turns. One of Immelmann's favorite maneuvers, on the other hand, was to allow an Allied pilot to take up a position in back of him—'on his tail'—and just when said Allied pilot was congratulating himself upon his skill in outmaneuvering the German, Immelmann would pull the nose of his machine up until he would nearly stall, and then rapidly pull it into a nose dive and turn almost within his own space, with the result that soon he was 'sitting on the tail' of the Allied pilot and sending him to his doom before he had an opportunity of recovering from his surprise. By maneuvering in this manner Immelmann was able to outmaneuver and gain what the pilots call a 'bead' on his opponents, and deliver the *coup de grâce* in the form of a shower of lead.

"In justice be it said that Immelmann and Boelke were perhaps better known than any other aviators in the present war, either in the German or Allied camps. The Germans idolized these two intrepid airmen. It was a boast in the music halls and cafés of Berlin that certain types of British machines manufactured in England by the Royal Aircraft Factory were 'fodder for the Fokker,' especially when the Fokker was piloted

by either of these crack airmen. . . . By the time the Royal Aircraft Factory machines were sent to the front they were already antiquated by the progressive German aircraft builders. For aeronautical progress moves fast on the Western front: a machine to-day may be without a rival; six months hence it is suicide to employ it against the enemy.

"In all, Immelmann and Boelke accounted for something like eighty Allied pilots, the majority of whom were flying Government-built machines that were absolutely useless in warfare of this kind; indeed, these machines were called 'suicide shells' by the officers of the British flying corps. They were so constructed that the machine-gun mounting was in a position where it was absolutely impossible for the pilot to fight unless he were running away from his opponent.

"Here, then, is a warning to the United States, or rather a lesson; for with its entrance into the war at a time when the Allies have been fighting close on to three years, the latest belligerent has an opportunity of learning the errors that have been made and how their repetition may be avoided. In fact, it is with this idea in mind that the Allied commissions have come to America.

"Captain Ball, the famous British pilot who has been decorated with the highest military orders of Great Britain, Russia and France, has to his credit over fifty victims. The machine he used on a large number of occasions was called the 'Red Devil' because the nose was painted red. The Nieuport Bullet, a French machine equipped with a LeRhone engine, the Sopwith Pup and the DeHaviland Scout, both British machines, and the Spad, a French machine making as high as 145 miles an hour, have also been used by Captain Ball on different occasions.

"Wandering off by himself and seeking out the enemy in back of the latter's lines appears to be Captain Ball's favorite method of fighting. On occasions he has swooped down to within a relatively small distance from the ground and attacked infantry in camps far in back of the fighting lines; and he has sought out and fought German pilots lurking in cloud banks. He has attacked enemy patrols single handed — in some instances as many as ten machines, and has had hundreds of miraculous escapes. British pilots are wont to believe that Captain Ba.. has a charmed life; indeed, he has been known to have had three forced landings in a single day as results of aerial battles, each time going up again as soon as another machine could be prepared for him. The Germans have set a price on his head; but so far he is still at large.

"The Lafayette Escadrille, composed of Americans, has brought down over thirty enemy machines. The young pilots of this corps are commended for their splendid spirit in going to France to engage in such hazardous work, especially those who have already sacrificed their lives for a cause which they so nobly espoused. Nieuport machines are used by the escadrille.

DIRECTING ARTILLERY FIRE FROM THE SKY

"Artillery observation is one of the most important branches of the service. So indispensable is the airman in connection with modern artillery that a noted authority recently stated that if one side had airplanes while the other had none, the war would have been over in six months.

Pilots and observers work in conjunction with a battery. They arrange beforehand with the general staff just where that battery is to operate. If they are ordered to seek out an enemy battery that may be lodged at the end of a wood or in some concealed position, the pilot maneuvers about under the instructions of the observer until the battery is spotted, whereupon its position is signalled back by means of a wireless set to the battery commander. After notifying his battery to open fire, the observer hangs over the position at a height of say 6000 feet to avoid the trajectory of the shells passing underneath his machine; and as the shells burst near the position under fire, the observer notifies his battery how short or how far ahead, or how much to either side the shells are falling. The observer then orders the pilot to proceed over the next position, and the operation is repeated. When the work is completed the airmen are ordered to return by means of signals in the form of canvas strips placed on the ground.

"All the while the observer is directing artillery fire his machine is being subjected to intense bombardment by anti-aircraft guns, which are firing shrapnel shells by the hundreds. Flying fragments of shrapnel are all about the airmen—beneath them, all around them, and above them. For three hours, at times, the airmen must endure this intense bombardment, and there is no telling at what moment the tail of the machine or some other vital part may be blown away, or when the machine may become wrapped in flames. The work is most dangerous and nerve-racking, and most of the pilots stutter after going thru this ordeal. Some have been known to be unable to screw a nut or a bolt, due to nervous ailment.

PHOTOGRAPHS THAT PAVE THE WAY FOR AN OFFENSIVE

"Thousands upon thousands of photographs are made of enemy positions prior to an important offensive, and the information contained in these photographs is invaluable in the preparation of maps and in the development of the battle plans. To accomplish this all-important work a number of airplanes, sometimes five and sometimes more, are sent up to take photographs behind the enemy's lines. The camera-carrying or reconnoissance machine is generally in the center with machines on either side, flying 500 feet above the one in the center. Then there are two following up the rear, 1000 feet above the ones in front. This arrangement of varying heights is carried out so that in the event of an enemy attack, particularly a nose dive at the reconnoissance machine, with the object of destroying the thousands of photographs that may be of vital interest to the general staff, the convoys can rush up and engage the enemy before he has had an opportunity of carrying out his attack. So the fast little 'vipers' or 'maggots' as they are called, guard the reconnaissance machine from overhead, underneath and the sides. They act in a capacity similar to the diminutive tor-

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pedo-boat destroyers which form a screen about a dreadnought in a submarine-infested sea.

"The convoys are looking for trouble and usually have no difficulty in finding it, particularly when a swarm of fifty to twenty German machines returning from a raid, swoop down from a height of 20,000 feet on the scouting fleet. A general alarm is given and the machines at the rear close in to protect the reconnaissance plane, whereupon a free-for-all fight ensues. Sometimes several of our brave fellows may be left behind while the reconnoissance plane endeavors to escape; and, depending upon the fortunes of the combat, one or more of them are shot down by the preponderant enemy. The enemy has a trick of coming up behind and attacking the rear machines so as to cut them off from the machines in front, which obviously results in each machine being overpowered; whereas if the machines were fighting as a squadron they would have a better chance of coming thru. By means of a signal pistol which throws smoke shells in the daytime and lights at night, the machines are instructed to close in. Paramount is the necessity of bringing the reconnaissance plane back to the lines, and to this end the convoys are sacrificed, if sacrificed they must be.

"All this, briefly, is in the day's work of the modern military airman."

[The Rise of the Royal Flying Corps. By B. C. Fellows. *Land and Water,* Aug 2, '17. 1400 words.]

Apart from the forces specifically allocated to Home Defense it may be stated that the R. F. C. to-day is approximately ten times the size that it was two years ago. In no branch has progress on scientific lines made greater strides. The training organization expands *with* the development of the forces in the field, and not *behind* it, and therein lies the secret of its success.

Italy

[Giant Italian Aircraft. Italy's Quiet Progress *Scientific American,* Sept 15, '17. 325 words.]

Reports now reaching this country indicate that Italy has produced the fastest airplane, the best climber, the largest machine, and a fleet of dirigibles which have performed marvelous work along the seacoast. As submarine chasers, the non-rigid dirigible type has proven very effective. The secret of Italy's success in aviation is due to the powerful and reliable engines which have been developed. It is asserted that the Italian engines of 500-700 horsepower have proved that larger airplanes than have been thought possible from an engineering standpoint can be built and flown successfully. To demonstrate this point, there is under construction an airplane using 3000 horsepower and designed to carry 50 passengers.

Typical of Italy's giant battle planes are the various models of the Caproni type. Some of these machines have a crew of four or five men and carry several hundred pounds of bombs.

Japan

[Airplanes at the Japanese Military Maneuvers. *Scientific American,* Mar 3, '17. 50 words.]

One feature at the Japanese military maneuvers last November was the participation of 16 airplanes, eight with the "invading" force and eight with the "defenders." A good deal of night flying was accomplished. Four machines made a distance flight of about seven hundred miles.

United States

[May Take Over Wright Patents. *Army & Navy Jour.,* Feb 3, '17. 600 words.]

Because the high tax laid on the aviation industry by the patent holders is discouraging the opening of plants for the construction of airplanes, the executive committee of the Advisory Board for Aeronautics has seriously considered the proposition that the government purchase the patents and throw them open to the public for use. A New York corporation, which owns all interests in the Wright patents, demands of every manufacturer using them, first, a bond of $10,000 as a guarantee that the output will aggregate a certain amount, and, second, five per cent. royalty on the gross income of the plant.

The shortage in this country of seasoned spruce and walnut, which have been purchased by foreign buyers, is another problem before this committee. The remedy suggested was government purchase of sufficient lumber, selling to the smaller manufacturer as required. This lumber is necessary in making struts, braces, and propellers.

[Great Air Program Planned. *Army & Navy Jour.,* May 26, '17. 525 words.]

America's war policy, as announced by the Council of National Defense, involves turning out 3500 air machines, including both training and battle types, during the next year, and the creation of an aircraft production board which will arrange for a constant stream of aviators and mechanics to the American forces in Europe. Aircraft schools and training camps will be established on a large scale.

[Progress in Aeronautics. By Major H. Bannerman-Phillips. *United Service Magazine,* June, '17. 2800 words.]

The whole of the aerial forces of the Central Powers have been controlled and organized thruout the war from the very efficient center in Berlin, whereas those of the Allies have acted independently and their mutual co-operation has had to be specially arranged for, thus giving the Central Powers the advantage in regard to strategy and organization. With very few exceptions, all of the heavier-than-air machines which the Allies have had working against them have been of German construction. With the opening of the war the manufacturer of airplanes in Germany ceased to be independent and has since been working entirely under Government direction, thus making the production easily controlled and standardized. Since the standardization of types, and to some

extent of parts, has become practicable, a new field for assisting the Allies is opened to America. The Central Powers have frequently been able to collect larger numbers of airplanes than the Allies at threatened points on the Western front during recent operations, but it is quite possible that the French and British, if they pool their resources without reserve, will be able to beat the Germans in regard to both quantity and quality of machines. Most of the machines have been copied from French models, but the Germans have excelled in output because of their long-prepared organization.

The British tractor scout machines of the latest type and their triplanes have a value from a fighting point of view. If they excel in the number of these they can secure the local supremacy which prevents the enemy airmen from carrying out their duties of reconnaissance and spotting for the guns, without which his artillery, and more especially his heavy guns, lose tremendously in efficiency. This means fewer losses for the British, the demoralization of the enemy, and ultimate victory. It would also mean that the Allies could afford to spare the requisite number of airplanes for systematic bombardment of the enemy's nerve-centers and the destruction by fire of growing crops ot cereals, which might do as much to reduce Germany's power of resistance as the decimation of her fighting force at the front. For such raids as these, the aviators who carry out the actual bombing operations need not be men with such finished training as is required for the duties of the Air Service with an army in the field. All that is necessary is that they be competent airmen from the flying point of view, practiced in bomb-throwing, and trained to work in unison with others, and to use a machine-gun in seif-defense. The United States could supply such men, train them locally, provide them with standardized machines expressly built for the work of bomb-dropping, and send one complete unit after another to the Western front as fast as they are turned out. They could travel in specially armed wooden vessels designed to minimize the risk of attack by submarines, and these would not interfere with the transport of munitions or supplies for other purposes. The moral effect of this would be very cheering to both the British and French troops.

The disadvantages of this plan are that the training, equipment, and transport of a force of any size would take long, the ships to carry them are at present unavailable, and the trained officers that formed the nucleus of the American land forces would be urgently needed for the organization and the training of the National army. On the other hand, the organization of a special Corps of Airmen could be proceeded with at once and independent of any other military forces in training. American men would revel in the work to be performed by an airman and would bring to it courage and brains and a natural adaptability, initiative, and resource in meeting unforeseen contingencies, while the comparative independence of action allowable in their special duties would peculiarly appeal to them. Once it has been fixed that two distinct types of machines are required, the designs could be fixed and the parts standardized. The big Italian Capronis appear to have been very successful for raiding and might prove the most suitable pattern for standardizing. The engines would be the most important point to consider, but the American industry would have two advantages; they would know the sole purpose for which the machines would be required, and they need not restrict the weight within such limits as would be required in a powerful machine to be used for aerial scouting and fighting. The design of the machine can provide for automatic stability, making it easier for pilots in the ease and safety in handling, and calling for less power of endurance in making long flights. The facilities afforded by climatic conditions and choice of locality for airdromes and training centers are also favorable.

The futility which often follows aircraft chiefly results from two causes: first, lack of numbers; secondly, old-fashioned machines unequal to heavy enterprises too frequently have to do work only suited for the latest designs. Both the Allies and the Germans have found it advisable to devote attention to the production of fast and quick-climbing airplanes for fighting and other purposes in immediate connection with the troops in the fighting line, rather than giant battle-planes or weight-carrying bombing machines capable of long-distance journeys. The efforts put forth in order to accomplish the systematic bombing of German nerve-centers and munition works might aid materially in the solution of the problem of trans-Atlantic flight.

[America's Aid in Aerial Warfare. *Army & Navy Gazette,* July 14, '17. 1800 words.]

The American Secretary of War has said that the addition of a few infantry units to the 7,000,000 men on the western front would not prove decisive, but that a few thousand trained airmen, with their machines, might spell the difference between victory and defeat.

These views are sound in principle, and American aid in aerial warfare will be most welcome. But rendering this aid on a large scale involves vast difficulties. There are few available instructors. America has hitherto supplied only training machines. Automobile engines have been produced in large numbers. But there are differences between these training machines and the bombing and fighting machines, and between automobile and aero engines. The standardization process may not be applicable to the latter.

America can undoubtedly enroll quickly a large number of young men suitable for the air service. What duties will they have to perform, and what average time will it take to train them?

Their duties are disclosed by the Messines operations. Here the British airmen observed the general movements of the enemy; furnished information to the general staff by photographic methods, and by oral, wireless, and written reports; spotted for the guns, found out what was going on behind the enemy lines; harassed the enemy by bombing his nerve centers and lines of communication; supported the infanty by machine gun fire during an attack; and prevented the

AERONAUTICS—Continued

enemy from performing corresponding services for their side.

The training of the Royal Flying Corps was reflected in the complete mastery of the air gained at this time. For days before the attack the General Staff was kept informed of every movement of the enemy. The airmen fully neutralized the advantage of the high ground held by the enemy.

When the attack commenced, the information furnished by the airmen was varied in nature and wonderful in accuracy, and included even the progress of the infantry in the attack. The qualification for such duties requires long and arduous training. The aviator requires not only a knowledge of aviation, but also a knowledge of military matters. He must know the use of machine guns and airplanes in the involved and complex fighting with enemy airmen equally well equipped with fighting aircraft, the practice of dropping explosives, observation for artillery, and the use of wireless in aircraft.

It does not seem possible for the United States to furnish a large contingent of airmen trained on the above lines within a year for co-operation with the Allied troops. But a large contingent of men trained for bombing work could be trained in a shorter period, thus taking care of the bombing of the nerve centers and ammunition depots behind the lines. The aviators could be taught to fly in America, and their training for this special work could be completed better in Europe, where they would have the benefit of instructors experienced in aerial work against the Germans.

Such a use of American airmen would leave the French and British airmen free to concentrate their efforts upon local co-operation with the troops. The aid thus rendered would be effective in the immediate future.

If this view of the rôle of the American airmen were accepted, they would require only to be taught to manage the large bombing planes, to drop explosives accurately, and to use the machine gun in self-defense. They could leave out of their training aerial fighting in its present elaborate form, observation for military purposes, and artillery spotting, thus considerably reducing the period of instruction.

American genius will undoubtedly produce a good aero engine suitable for a bombing machine, and we shall welcome their advent in the numbers possible thru standardization. Meanwhile a beginning might be made by building the first few hundred machines on British and French designs of proved value without prejudice to future output.

[Aviation Bill a Law. *Army & Navy Jour.*, July 28, '17. 200 words.]

The Aviation Bill, carrying an appropriation of $640,000,000, was passed by the Senate on July 21 and signed by the President July 24.

—Accidents

[Aeroplane Accidents: Causes and Remedies. By Lieut. R. C. Saufley, U. S. Navy. *Proc. U. S. Naval Institute*, July-Aug, '16. 6500 words. 50 diagrams.]

Airplane accidents are obviously attributable to three general causes—(1) air conditions; (2) material; (3) personal error. A very careful analysis of these items, especially the study of pressure of cambered surfaces and descriptions of actual cases of accidents with their causes, leads to the conclusion that there is no doubt as to aircraft being entirely capable of performing their full mission.

—Altitude Records and Indicators

[Progress in Aeronautics. By Major H. Bannermann-Phillips. *United Service Magazine*, Jan, '17. 3200 words.]

On the 9th of November last the Italian aviator, Lieut. Guido Guidi, started from the aerodome of Mirafioro, near Turin, and, in a flight of an hour and fifty-seven minutes, reached a height of 25,800 feet. His notes of the temperature at that altitude are useful for the guidance of others who may endeavor to surpass his achievement. At 20,000 feet it was 58 degrees below zero. In addition to any special oxygen supply for enabling the aviator to breathe with comfort in the rarefied air at 25,000 feet, it will be advisable for him to have some means of keeping himself from being rendered unconscious and helpless from cold and retaining sensation in his hands for the better handling of controls, such as the electrically warmed gloves on the market.

—Armament for Airplanes

See also

AERONAUTICS—MATERIEL (Article: "Battleplanes and Aircraft Guns")

[Feeding the Battling Airman's Machine Gun. *Scientific American*, Oct 13, '17. 350 words.]

With a battleplane flying at all angles and even upside down the difficulty of maintaining a uniform, reliable feed for its machine guns presents a hard problem for designers. It is the sure feed of its disk magazine that has made the Lewis gun so suitable for airmen, aside from its light weight.

Recently the designers of battleplanes introduced a reel method of feeding a machine gun. The regulation belt with its cartridges is held on a reel at one side of the gun. In some cases the empty canvas belt is collected in a suitable receptacle at the other side of the gun, while in others a spring operated reel is employed to take up the belt, so that there is no chance for warped, twisted, or entangled belts.

In some German machines, the ammunition belts feed out of one magazine situated beneath the gun, into the gun and out at the other side into a second magazine.

—Attack

See also

ROCKETS—ANTI-AIRCRAFT

[Fire Against Aeroplanes. By First Lieutenant Dubois. *Revue Mil. Suisse*, Apr and May, '16. 8000 words. Diagrams and illustrations.]

I wish to show the factors which affect fire against aeroplanes and which make it not only difficult but singularly inefficacious.

Rifle sights are regulated for horizontal fire and should not be set at the actual distance in high angle fire. Supposing a machine directly above the firer and immobile, the firer should use no sight elevation. Between horizontal fire and vertical fire, there are all the cases of high angle fire.

The vulnerable surface of an areoplane is only from 6 to 8 per cent. of the total surface, and the planes can be pierced many times without bringing down the machine. It is not likely that the pilot will be hit, for most machines are protected by chrome steel armor 4 mm. thick, impenetrable beyond 700 meters and resisting shrapnel fragments beyond 1000 meters. The most vulnerable parts are the propeller, the gasolene tank, the motor, the wire struts, and the control.

Machine gun fire and shrapnel are more effective, naturally, than rifle fire. The present rifle sight is faulty for high angle fire. Two factors enter into consideration here: the distance and the angle which the trajectory makes with the horizontal. This angle changes rapidly on account of the speed of the target.

The bullet is much affected in its flight thru the varying strata of the air. It loses much velocity and has not the opportunity of regaining it in high angle fire that it has in the descending part of the trajectory in horizontal fire. The varying density of the air strata also affects the observation of the object. This refraction effect is, however, inconsiderable. Another phenomenon is the invisibility of the mark at a certain height. It is almost impossible to pick up with the eye an aeroplane flying at from 2000 to 2500 meters.

In high angle and vertical fire, it is impossible to estimate the effect of the wind on a bullet. Passing thru different strata, it is influenced by winds varying in velocity and even in direction.

These would, perhaps, be surmountable difficulties if the target were fixed, but to the problem is added the fact that the object is moving and moving rapidly. The effect of the wind to accelerate or retard an aeroplane moving at a given speed of motor has also to be considered.

The firer should, of course, aim ahead of the moving object, but, in the excitement of the moment, he often forgets to do so. At a distance of 300 m. he should lead a machine moving at 130 km. an hour about its own length; at 2000 m., about 17 lengths. This lead is, naturally, very difficult to estimate.

It may be said that the very best of estimators will make an error of several hundred meters in estimating the distance of an aeroplane. Telemeters would give a sufficient approximation of the distance, but measuring is made difficult by the rapid velocity of the target. A simple contrivance has been devised which enables one to read the distance according to the apparent size of the objective. It is based on the mil system and is simply a piece of metal notched so as to resemble crenelations. When the objective just fills one of these spaces, one may compute the distance:

$$\text{Distance} = \frac{\text{length of aeroplane}}{\text{width of notch}}$$

This means is very imperfect, for not only does the length of an aeroplane vary with the model, but its apparent size varies according as it is seen head on, sidewise or obliquely.

Field glasses graduated in mils may also be used, but with them, as with the foregoing methods, an error of from 200 to 300 meters cannot be excluded.

Exactness is not guaranteed by any of these methods.

The officer commanding fire against aeroplanes must not lose sight of the fact that projectiles missing the mark will come down with a speed approaching the initial velocity and will have sufficient force to be deadly.

Everyone should be acquainted with this fact: to hit a point in space by high angle fire, do not use the sight setting corresponding to the actual distance, but take a sight-setting less than the real distance. This setting will be less and less as the vertical is approached.

It must be noticed that the energy of the bullet decreases rapidly with distance. Speed is lost more rapidly in high angle and in vertical, than in horizontal fire. Results cannot be corrected beyond 200 meters, even with machine guns.

These principles are put into practical use as follows: On a quadrant are constructed:

1°. A division into degrees;

2°. Curves which, for any sight setting give a hit for direct aim at the target;

3°. A movable index bearing the same graduations as the sight;

4°. The curve limiting the dangerous zone, beyond which fire is not effective.

If an aeroplane is in view, the man with the telemeter measures the radial distance. Another man furnished with a very simple apparatus (a quarter-circle divided into degrees and a ruler along which to sight) indicates the angle of departure from the horizontal. The officer directing the fire sets the index at this angle on the quadrant described above and notes which of the curves (2°) coincides with the radial distance (3°). For example, with a radial distance of 2000 meters and an angle of 38°, the proper sight-setting is 1800 meters.

Both observers, the one with the telemeter and the angle-measurer, keep announcing their observations. The firer has to keep altering his sight and has to aim ahead of the target as previously indicated.

In completely open ground, the infantryman lies on his back; he uses his pack as a pillow. Standing or kneeling, any tree, palisade or hedge gives him a rest for his aim. Supports can be improvised of horizontal poles at a height of 2 meters from the ground. These arrangements may be used by one or more sections of infantry.

Our infantry machine gun companies have been ingenious in contriving supports giving the piece a maximum of elevation and permitting a rapid change in the direction of the fire. One of these is a solid stake with a pivot at the top on which turns a horizontal bar.

A practical method used by our neighbors is the horizontal wheel on which a machine gun is mounted

AERONAUTICS—Continued

by supporting the legs of the tripod on the felloe. The wheel itself placed on a cask turns about a stake fixed in the ground. A circular ditch enables the firer to sit down and fire comfortably.

Machine gun limbers can also be used as supports, and special trucks have machine guns mounted on a high tripod.

The trails of field guns are put down a slope or in a ditch. To prevent a possible recoil the wheels are tied to stakes.

I have tried to show what factors enter into high angle and vertical fire and how complicated fire against aeroplanes is. It is evidently difficult for infantry or machine guns to damage air-machines and even with artillery, the ammunition expended is out of proportion to the results obtained.

At present, it is customary to send aeroplanes to bring down aeroplanes by machine gun fire. Many squadrons are thus organized: one-third of the machines are used for reconnaissance, one-third for aerial combat, and one-third for the bombardment of land targets.

(The author shows by diagrams or deduces by formulae the principles given in this digest.—Ed.)

—Attack—Protection Against

See also

Bullets—Incendiary

Great Britain—Military policy of (Article: "The Air Defense of London")

["Anti-Zep" Aeroplanes. *Scientific American,* Jan 20, '17. 400 words.]

The British have developed airplanes with climbing powers sufficient to enable them to reach Zeppelin altitudes in time to meet the raiders. These machines are of comparatively small wing surface, and are driven by unusually powerful engines, capable of making speeds of 120 to 140 miles per hour. The climbing speed has increased in the past few months from an ascent of 10,000 feet in 6 minutes to 15,000 feet in 7½ minutes. The scouting service is so effective that warning is given the airplanes defending London in time to permit them to rise to their positions before the Zeppelins arrive. The incendiary bullet is the most effective means used to bring down the raiders.

[Progress in Aeronautics. By Major H. Bannermann-Phillips. *United Service Magazine,* Jan, '17. 3200 words.]

Since the outcome of the Zeppelin raid at the end of November, it is to be presumed the German Government will consider that the threat to overwhelm London with destruction by means of airships must be considered abortive, and that raids even on the northeastern and Midland towns are likely to turn out disastrously for the raiders. Apart from their usefulness as naval scouts, the Zeppelin dirigibles do not seem to have justified their continued existence and the drain in men and resources which they involve. In the five raids which occurred from September to the end of November, the enemy lost six airships, and the raiders learned by painful experience that not only were the anti-aircraft defenses, mobile and otherwise, ready and efficient on land, but the airships were pursued out to sea and there subjected to the combined attacks of marine vessels and aircraft.

[Naval Anti-Aircraft Defenses. By Henry Woodhouse. *Flying,* Apr, '17. 3750 words. Illustrated.]

Naval anti-aircraft defenses are divided into three classes: the flying defense, consisting of fighting aircraft, which includes armed seaplanes and armed dirigibles; floating defenses consisting of anti-aircraft guns mounted on different types of ships; and the shore and anti-aircraft gun defenses, consisting of anti-aircraft guns, searchlights, listening towers, and range finders. The anti-aircraft guns are 3 inch, 50 caliber guns, firing a 13-pound shell. The movement is so arranged that the gun can fire from 10 degrees depression to 90 degrees elevation. The gun is semi-automatic, allowing a rate of fire of more than twenty shots per minute. At the beginning of the war the Germans were using a 4.1-inch gun, 45 calibers, firing a projectile weighing 34 pounds, with a muzzle velocity of 2630 feet to a height of 12,000 feet. The rate of fire was fifteen shots per minute. Since that time guns have been put to use which are capable of firing as high as 28,000 feet. The Krupp 6-inch gun, firing a 35 pound projectile, with a smoke trail, is used by the German coast defenses, and by its Navy. The most remarkable gun is the Erhardt, with a 2.6 inch shell, weight of projectile nine pounds, elevation 75 degrees, muzzle velocity 2000 feet per second, and ready for range of 17,500 feet. Due to the wide use of aircraft in military operations, there is an overlapping co-operation between the air service of the Army and the Navy. It is considered best for our purpose to adopt the rule that the Navy's duties begin outside the three-mile limit.

In the case of Great Britain a great deal of confusion has arisen on the subject as to whether the air service or the Army or Navy is responsible for home defense, or whether the responsibility is divided. The truth is that the Navy was entirely responsible until February last. Since that date the responsibility has been divided, the Navy being responsible until the hostile aircraft reached the coast, and from that time the Army is responsible. In a report of investigation of the complaint that no machines went up on the occasion of the raid on Dover by a German seaplane about Feb 21, 1916, it appears that Dover is a naval war station, and that the Royal Flying Corps merely had a training and mobilizing camp there. On the date in question General Henderson was there inspecting. The only portion of the Royal Flying Corps in Dover at the time was a half-completed squadron ready to go abroad. Directly the guns were heard, the pilots on duty ascended in pursuit, and were immediately followed by two naval machines, and these again by another army machine. As the machines went up in the opposite direction to Dover, they were not seen by the inhabitants of the town, and as the day was

rather misty, and the German seaplane 8000 feet up, the British machines were unable to catch it.

During 1916 the British destroyed 247 and brought down, in a damaged condition, 142 German airplanes. Eight Zeppelins were destroyed, four by aviators, and four by anti-aircraft guns. The French destroyed 417 and brought down, in a damaged condition, 195 airplanes. Efficient anti-aircraft defenses in 1916 resulted in cutting down the insurance against enemy aircraft. Two shillings is the present rate for insuring, for £100, private houses and their contents, and buildings in which no trade is carried on. Our anti-aircraft defenses are far from being sufficient to meet an emergency, and it will be necessary to make up for this deficiency by organizing numerous squadrons of fighting seaplanes and mounting anti-aircraft guns on the new submarine chasers and fast motor boats. The task of the reserves will be to prevent aircraft from reaching the shores after the aircraft have passed the anti-aircraft guns on the battleships.

—"Battle Planes"

See also

AERONAUTICS—MATERIEL.

[Battleplanes and Aircraft Guns the Dominant Factors in Mantaining the Supremacy of the Air. By Henry Woodhouse. *Flying,* July, '17. 6400 words. Illustrated.]

Supremacy in the air, the all important factor which leads to victory on land and sea, depends greatly on battleplanes and aircraft guns.

Proportions of different types of armed airplanes in the air service vary continually, in accordance with developments, and the future will see an increase in the number of bombing machines with possibly an increase of pursuit machines.

But whereas pursuit machines will always be needed to fight enemy aviators, the practice of sending pursuit machines to protect the artillery spotters and photography planes will grow less and less, because it is more economic to employ large machines capable of carrying two or more guns and to defend themselves.

Many a photography plane, equipped with only one gun, has been brought down by an enemy aviator who darted at it suddenly and riddled it with shots while the observer was taking photographs and did not see it approach.

The five fundamental factors in maintaining supremacy in the air are:

(1) Speed.
(2) Position of the airplane.
(3) Skill in piloting the airplane and in manipulating the guns.
(4) Number of airplanes.
(5) Destructiveness of the projectiles.

The French have the following types of airplanes:

Avions de Chasse or Combat Machines

(1) The "Spad," carrying one passenger, equipped with Hispano-Suiza motors of 200 h.p. and 220 h.p.; capable of a speed of from 200 to 210 kilometers per hour; equipped with a Vickers or Lewis machine gun, synchronized to shoot thru the propeller.

(2) The "Nieuport," one passenger, equipped with one 110 h.p. Le Rhone motor, capable of a speed of 150 kilometers per hour; equipped with a Vickers or Lewis machine gun, synchronized to shoot thru the propeller.

The Avro, carrying one or two passengers, equipped with one 100 h.p. Gnome motor, carrying one or two guns.

Avions Type "Corps d'armée"—Used for Spotting Artillery Fire, Aerial Photography, etc.

(1) The "Caudron" G-4; pilot and observer; equipped with two 80 h.p. Le Rhone motors.

(2) The "Caudron" G-6; two passengers; equipped with two 110 h.p. Le Rhone motors, carrying one machine gun forward and one in the rear.

(3) "Dorand" A-R; two-passenger; equipped with one 150 h.p. Hispano-Suiza motor or a 170 h.p. Renault, carrying one Vickers gun forward, synchronized to shoot thru the propeller, and two Lewis guns in the rear.

(4) Farman; pusher type, two-passenger; equipped with one 170 h.p. Renault motor, carrying one or two Lewis guns forward.

(5) Morane Parasol, two-passenger, one 110 h.p. Le Rhone motor, mounting one Lewis gun in the rear.

(6) Caudron R-4; three passengers; equipped with two 150 h.p. Hispano-Suiza motors, with two Vickers guns mounted forward in turrents, and two Lewis guns in the rear.

(7) Letort; equipped with two 150 h.p. Hispano-Suiza motors; two Vickers guns mounted forward in turrents and two Lewis guns in the rear.

(8) Moineau; three passengers; one 220 h.p. Samson motor, connected to drive two propellers; equipped with two Vickers guns mounted forward in turrets; and two Lewis guns in the rear.

Daylight Bombing Airplanes

(1) Sopwith; one passenger biplane, equipped with 130 h.p. Clerget motor capable of a speed of 160 kilometers, and capable of carrying twelve bombs and one Vickers gun, shooting thru the propeller.

(2) Sopwith biplane; two-passenger; equipped with 130 h.p. Clerget, carrying eight bombs; Vickers machine gun forward; shooting thru propeller and one Lewis gun in the rear.

For Night Bombing Raids

(1) Voisin-Peugeot; two-passenger; equipped with a 220 h.p. Peugeot motor; carrying two Vickers guns forward, shooting thru propeller.

(2) Breguet-Michelin; two-passenger; equipped with one 220 h.p. Peugeot motor; mounting two Vickers machine guns forward, shooting thru the propeller.

(3) Farman, pusher type. two-passenger; equipped with one 170 h.p. Renault motor, mounting one Lewis gun forward.

At date of writing, the British, French and Germans can be said to have more or less the same types of airplanes, with the same amount of armament.

The German combat machines are the Ago, the Fokker, the Halberstadt, the Roland, which are equipped with Mercédès, Oberunsel (rotary), Benz and Argus motors of 165 to 175 h.p.

AERONAUTICS—Continued

The two smallest machines, the Halberstadt and the Albatros Bu, are single seaters, all the others being two-seaters. Where the gunner occupies the rear cockpit it is found that in many cases that the pilot is equipped with a synchronized gun fired forward and sighted by steering the machine itself. The same applies to the single seaters. Some of the single seaters are equipped with two synchronized guns fired directly in front.

The battleplane, while representing only one-fifth of the types of machines used in the present war, is the key to command of the air, because the skies must be cleared of enemy aviators before the scouts, bombing, artillery and infantry airplanes can work efficiently.

As a general rule, however, speed is the basic factor for achieving command of the air, hence every effort is made to get speed, and the factor of safety in construction is given only second consideration, when it is considered at all.

The triplane is safe even if a wing is shot away; the remaining wings will support it for the rest of the flight under any normal conditions. A biplane usually collapses soon after a wing has been shot away, and a monoplane collapses immediately.

The larger army machines are four: The "Moineau," the "Voisin-Peugeot," the "Breguet-Michelin" and the "Farman." These may be called "Destroyers," no matter what they may be used for. The most popular British machines of this type is the "Handley-Page."

The Germans have several machines of this type. The twin "A. E. G." is a three-seated tractor biplane with two 180 h.p. Mercédès motors.

The "A. G. O.," a twin-bodied pusher, usually equipped with a single Bentz 175 h.p. motor.

The twin-motored 520 h.p. "Gotha" is a three-passenger biplane usually equipped with two six-cylinder Mercédès motors of 260 h.p.

The airplane guns and cannons employed to-day were developed in the year 1912-1914 and perfected as far as their perfection goes, during the war.

The most extensively used airplane guns of small caliber are the Lewis and the Vickers by the Allies and the Maxim and the Parabellum by the Germans. The Lewis machine gun is an air-cooled, gas-operated, magazine-fed gun, weighing about 26 pounds with the jacket, or 18 pounds without the jacket.

The Vickers is a water-cooled, recoil-operated, belt-fed machine gun. Like the Lewis gun, it is capable of being fired at the rate of 300 to 500 shots per minute maximum. Its advantage over the Lewis gun is that it is capable of being fired continuously up to 500 shots, whereas the Lewis requires changing of magazines after 97 shots.

The German Maxim is practically the same as the Vickers gun used by the Allies.

The Colt, a gas-operated, air-cooled, belt-fed, automatic gun, was used as airplane gun in the beginning of the war, but there are few in use now. That is also true of the Hotchkiss and the Benét-Mercier. which is a modification of the Hotchkiss.

Details about the larger airplane guns have been kept very secret, but there are many in use, there being squadrons of large airplanes equipped with them. A Hotchkiss one pounder or one inch gun has been used in France and England. A Vickers pom-pom, or one inch, weighing 180 or 190 pounds, is reported as giving good results. The Davis gun, the invention of Commander Davis, of the United States Navy, made in one inch and three-inch sizes, is a most remarkable weapon.

So far no progress has been made in the armoring of airplanes. To have an effective armor to protect the pilot and the vulnerable parts would involve prohibitive weight, which would cut down the efficiency of the airplane beyond the safety point. The vulnerable parts of the airplane are: (1) the pilot; (2) the gasoline tank; (3) the propeller; (4) the motor; (5) the control wires.

A bullet striking the strut or the rib of an airplane just leaves a hole, but very rarely does more damage than that. A shell striking the same part will wreck the plane. Hence, the shell has its advantages.

However, the necessity of having rapid fire in aerial fighting precludes the possibility of the large gun replacing the smaller gun.

For the sake of avoiding confusion it is well to separate air duels into four classes, as follows:

(1) Air Duels in Which Participants are Both Air Fighters Whose Only Function is to Keep the Sky Clear of Enemy Machines:

The aviator having this mission to perform usually flies out with a speedy machine equipped with from one to three airplane guns and flies as high as he can and remains high until he sees an enemy machine. Then he dives down towards it and tries to bring it down by opening fire on it as he gets to firing distance, keeping up the stream of fire until he sees the enemy machine fall; if he misses hitting a vital part, he must either land, if he is near his own lines, or maneuver to a point of vantage to shoot at the enemy again, or try to rise vertically, as quickly as possible, and maneuver for a high position again before the enemy gets to the point of vantage to open fire on him.

(2) Air Duels Between Combat Machines and Armed Photographing, Spotting, or Bombarding Machines:

A duel between a combat machine and armed photographing, spotting or bombing machine is quite different from the duel between the combat machines. The combat machine will dive on the armed larger machine, which will receive it with upward fire from one or more guns. If the combat machine succeeds in hitting one of the gunners, it silences only one of the guns, but still has to deal with the other gunners and guns.

(3) Air Duels Between Large Armed Airplanes:

In air duels between large armed airplanes the tactics are different. These types of machines, being usually busy with taking photographs. spotting or bomb dropping, seldom go to great heights; and they are not so well adapted to diving and swift maneuvering as the combat machines.

Formation in air fighting is part of the latest developments in the aerial part of the war. Fighting in

formation begun in the early part of 1916, and by the spring of 1917, in the intensive air fighting that preceded the Allies' drives, aerial combats had taken place in which as many as forty airplanes participated on each side.

There are many instances of individual aviators who fought from 4 to 10 enemy aeroplanes and came out victorious, altho not, of course, bringing down the 10 machines.

The High Command of the German Flying Service instituted some months ago the system of mobile chaser squadrons, consisting entirely of picked fighting pilots. These squadrons move en masse, as a complete unit, from place to place, and keep the air as clear as may be of hostile machines wherever they are thickest. The system has much to recommend it as against the system of splitting a fighting squadron up among several bombing squadrons so that two or three of its machines are told off at a time to protect the slower types.

[Manhunters of the Air. By James Middleton. *Air Service Jour.*, Nov, '17. 3000 words. 14 sketches.]

Battle planes fly at an elevation of 15,000 or 20,000 feet. Their business is to clear the heavens of enemy aircraft and make it possible for the other types to perform their allotted duties. Reconnaissance machines fly at about 6000 feet. They make all possible observations of enemy terrain, including photographic records, and so serve as the "eyes of the staff." Spotting machines fly at about 5000 feet. They devote all their energies to locating enemy positions and so serve as the "eyes of the artillery." Bombing planes fly as low as 500 feet at times, destroying enemy entrenchments, assailing the enemy infantrymen with machine guns and performing reconnaissance work for their own battalions.

The prescribed line of battle formation places, high in the air, a large flotilla of fighting machines. The other types can perform their duties only under the protection of the fighters. Reconnaissance and bombing planes do not fight except in self defense, altho all carry guns which are used in case the enemy fighters are encountered.

The battle plane in itself renders no service to the fighting armies. Its activities merely make it possible for the larger machines to do their work, as it speeds up and down the lines, attacking enemy planes of all types. Its energies decide the control of the air.

[The author describes numerous methods of attack used by several of the most successful aviators of the Allies and the Germans.]

—Bombs and Bomb Dropping

See also
BOMBS—AERIAL—LAUNCHING OF

[The Warplane for Bombing and Torpedo Attacks. By Henry Woodhouse. *Flying*, Aug, '17. 5800 words. Illustrated.]

It is generally agreed that the most effective and quickest way of achieving victories of decisive importance over Germany is by: (1) Conducting substantial bombing operations against German military centers, military supply bases, and railroads; (2) By conducting substantial aerial operations against the German fleet with torpedoes launched from torpedoplanes and striking the U-boat bases with bombs dropped from the air, as well as with shots from airplane guns of large caliber.

Aircraft can fly over all obstructions, both in the sea and on the land, as tho they did not exist. At night airplanes can hardly be seen a hundred feet away by other airplanes, and it is a most difficult thing for search-lights to locate them in the sky. In scores of cases single airplanes or fleets of five or more have carried on bombing raids during the night without being seen by the Germans. Therefore, the solution of striking Germany thru the air rests in night raids. Neither the Allies nor the Teutons have had sufficient number of large airplanes to permit them to conduct major aerial operations against the other side.

The Allies now have huge warplanes and torpedoplanes capable of carrying from two tons to three tons of explosive. The gigantic Caproni torpedoplanes permit aerial operations from any of the Allied bases to any German naval or military base and return with substantial reserve fuel. Italy leads in types of bombing and gun carrying airplanes. The following are some of the most important types of Italian machines: (1) The 1800 h.p. Caproni triplane. This remarkable warplane is equipped with three 600 h.p. Fiat motors. (2) The 600 h.p. bombing type Caproni triplane. This machine carries a useful load of 4400 pounds, which permits carrying fuel for six hours, a crew of three, three guns, and 2750 pounds of bombs. It has a speed of close to 80 miles an hour, and is capable of climbing 3250 ft. in thirteen minutes, 6500 ft. in 27 minutes, and 10,000 ft. in 57 minutes. (3) 600 h.p. bombing type Caproni biplane. This type of machine is most remarkable for its speed, which is 92 miles per hour. It is equipped with three Fiat or Isotta-Fraschini motors of 200 h.p. and three propellers, two tractors and one pusher; it carries a military load of 3200 pounds, including fuel for four hours, a crew of three, three Fiat guns, and 1150 pounds of bombs. It can climb 3250 ft. in six minutes 30 seconds, 6500 ft. in 14 minutes 35 seconds, 10,000 ft. in 35 minutes 30 seconds, 13,000 ft. in 40 minutes. (4) The 450 h.p. bombing type Caproni biplane. This is a biplane with two fuselages and three 150 h.p. Isotta-Fraschini motors, two in front and one in the rear, two tractors and one pusher. It carries 2200 pounds of useful load, which is usually divided into fuel for four hours, a crew of three, three guns, and 450 pounds of bombs. It has a speed of 85 miles an hour, and a climb of 3250 ft. in 5 minutes and 30 seconds, 6500 ft. in 12 minutes 10 seconds, 10,000 ft. in 21 minutes, and 13,000 ft. in 30 minutes. (5) The 200 h.p. S. I. A-7B armed reconnaissance biplane. This machine is a two seater tractor biplane equipped with a 200 h.p. Fiat engine, carrying a useful load of four hours fuel, two people, two Fiat guns, firing thru the propeller, and 135 pounds of bombs. It has a speed of 118 miles per hour and a

AERONAUTICS—Continued

climbing speed of 3250 ft. in 3 minutes, 6500 ft. in 7 minutes 30 seconds, 10,000 ft. in 12 minutes.

The British *Handley-Page* is equipped with two 280 h.p. Rolls-Royce motors. This biplane has carried 21 passengers in one flight and has a wing spread of 98 ft. for both top and bottom planes. It has mountings for 3-in. guns.

Caudron R-4, three-passenger; equipped with two 150 h.p. Hispano-Suiza motors with two Vickers guns mounted forward in turrets, and two Lewis guns in the rear.

Sopwith, one-passenger biplane; equipped with 130 h.p. Clerget motor capable of a speed of 160 kilometers, and capable of carrying twelve bombs and one Vickers gun, shooting thru the propeller.

For night bombing raids: *Voisin-Peugeot,* two-passenger; equipped with a 220 h.p. Peugeot motor, carrying two Vickers guns forward. *Brequet-Michelin,* two-passenger; equipped with one 170 h.p. Peugeot motor, armed with two Vickers machine guns forward.

Among the most remarkable long-distance bombing raids were the raids on Essen and Munich by Captain de Beauchamp and Lt. Dancourt, on Sept 24 and Nov 18, 1916, which have been repeated since by other aviators. The raid on Ludwigshaven, accomplished on May 27, 1915, in which eighteen airplanes took part, also involved a flight of about 400 miles. The damage that can be done by bombs is extensive, particularly in thickly settled places. In fast raids, whole factories and magazines have been blown up, railroad stations wiped out, bridges wrecked, hangars and dirigibles destroyed, ships sunk in their docks, military camps and billets broken up. Night facilitates bombing at very close range. The aviator can fly close to his target and hit in the most vulnerable points. The first part of aerial attack can be carried out by surprise and half the work done before the search-lights and anti-aircraft guns are put in operation. If the night should happen to be extremely dark the airplanes could light up the area to be bombarded by dropping parachute flares.

The following kind of bombs are in use: 16 lb. bombs, 56 lb., 100 lb. and 112 lb. In some cases there are bombs weighing 500 lbs. or more.

Dropping bombs weighing 500 lbs. or more is not difficult; heretofore it has been more difficult to get large airplanes capable of carrying them. Now that large warplanes are coming into use in quantities the dropping of bombs weighing 500 lbs. or more will be common, likewise the launching of torpedoes weighing from 200 to 1500 pounds.

The bomb dropping mechanism of a Zeppelin captured by the British had sixty bomb droppers for conical bombs. The base is slung in straps, and there is a strap around the neck. The latter has a releasing hook and when the releasing hook is operated the small end first drops down and the base slides out of its straps. The bomb then rights itself and drops base downward. The bombs are slung in one or two lines along the under side of the main hull. Each bomb has a separate switch. The bombs can be released by hand levers also, in case the electric means fail. Each bomb has a safety device and is not "alive" until it has dropped several hundred feet.

There are many different bomb sights in use. (1) The C. F. S. (Central Flying School) Sight: This sight can be used practically from any height with fair success. (2) The Low Altitude Sight: This is an exceptionally simple sight and very effective. It is only used under 1500 feet. It has three bars arranged as in the C. F. S., but the slide is graduated only in m.p.h. and the bottom bar is on a slide graduated in hundreds of feet, 20, 30, 40, 50, up to about 120 m.p.h.

Night bombing requires good knowledge of aerial navigation by instruments. The instruments used in the British Naval Air Service for night bombing are: (1) Compass—(2) Air Speed Indicator or Meter—(3) Spirit Level or Lateral Inclinometer—(4) Inclinometer —(5) Altimeter.

In England during the early days of Zeppelin raids, the casualties resulting to pilots who went up at night to attack Zeppelins was very high. This was mostly due to two things: (1) An insufficient number and badly lighted landing places. (2) Lack of lighting devices on the machines. In one instance, fifteen pilots went up and twelve smashed on landing.

In addition to the Very pistol, night flying machines are specially equipped with a parachute flare. This is fired electrically from the pilot's seat, thru a tube. On release, the electric connection is made and the flare, unfolding a couple of hundred feet, explodes, releasing a small silk parachute with a very bright light attached. This illuminates the country for a radius of perhaps a quarter of a mile, and gives the pilot a chance to select a desirable landing ground. Navigation lights are composed of one light in the tail and one on each wing tip. The wing tip lights show a white light forward, a green light on the starboard side, and a red on the port side. The power for these electric landing lights is obtained from a small dynamo driven by a miniature propeller. The work of the night bombing squadrons can be made much easier by the equipping of the bombing machines with the Sperry Automatic Pilot. The most evident advantages that the Automatic Pilot secures in bombing operations are the following: (1) The facilitating of night flying. (2) The accuracy and simplification of bomb dropping. (3) The elimination of one man. (4) The reduction of physical effort on the part of the pilot.

The increased accuracy of bomb dropping from an airplane equipped with the Automatic Pilot is due to—(1) Being able to get the airplane more accurately laterally over the target. (2) Being able to release the bomb at the proper angular distance from the target. (3) Simplifying the operation of bomb sighting, since the sight is held automatically and absolutely horizontal, thereby allowing the pilot bomb-dropper to focus his entire attention to adjusting the sight and steering the airplane. Supposing 1000 warplanes were to start from the Allies' lines in a major operation against German bases. They would start from different aerodromes probably one hundred from each, the machines

following each other at intervals of thirty seconds. Squadrons of 25 machines would probably be formed, with a flight commander to each squadron, who would start first. They would travel the 275 miles between the Allied bases and the German naval bases in three to four hours.

—Coast Defense, Use of in

See

UNITED STATES—COAST DEFENSE—USE OF AIRCRAFT IN

—Combat

[Bringing Down a Zeppelin. Note. *Scientific American*, Nov 25, '16. 200 words.]

The aeroplane used carried a suspended grapnel to engage and tear the envelope. On the grapnel was an electric igniting device to ignite the liberated gas. London had sufficient notice of the coming of the Zeppelins to enable the aeroplanes to gain the necessary altitude for a swooping attack.

[An Explosion in the Air. The Wily Enemy. *Sphere*, Dec 30, '16. Drawing and description. 200 words.]

There have been recently persistent attacks against the German observation balloons, and none of them can remain aloft long without receiving attention from the Allied airplanes. Recently the Germans sent up an old balloon with its car filled with explosives. Shots from the attacking aeroplane exploded (exploded from the ground by electricity?—ED.) the car, and the aviator had a narrow escape from destruction.

[The Aerial Combat. *Army & Navy Gazette, & Broad Arrow*, Sept 8, '17. 900 words.]

To send aviators up to fight without specialized training and in any but the best machines for the purpose, in the light of our present knowledge and experience, is a conscious, deliberate, and useless sacrifice of life. As regards the comparative value of airmanship and marksmanship in overhead fighting, the position of affairs now is that owing to the short range at which firing takes place, the ability to maneuver for position, the skill required in so controlling the airplane as to present as bad a target as possible, and the quickness of decision and combative attributes generally necessary in fighting at close quarters are as important as fine marksmanship, judging distance, and the qualities generally which make for good shooting.

It seems likely, however, in future, with increased practice and special training, it will be possible to bring machine guns and automatic or semi-automatic guns of larger caliber into action at much longer ranges with equal chance of hitting the vital parts of an airplane by successive bursts of fire, and then the value of good shooting will be paramount. One effect of this will be that an airplane engaged in reconnaissance, photography, etc., will on emergency be able to protect itself against the enemy fighting machines better than it can at present.

—Design of Airplanes

See also

AERONAUTICS—THEORY OF

[Engine Mounting in British and French Machines. *Aerial Age Weekly*, Oct 9, '16. 350 words. Illustrated.]

In order to get the strength necessary to support the Gnome and other rotary motors, the English and French manufacturers have found it necessary to extend the fuselage beams well out in front of the wings and attach the front and rear engine bearers rigidly to them. The Morane-Saulnier had two cowls, both used to stream line the fuselage, one in front of the engine with holes to permit the air to enter for cooling the engine, and one in the rear that was solid. However there were holes in the sides of the front cowl to permit the air to leave the engine partition. All constructions are designed so that there will be a minimum head resistance. In some cases as the Nieuport, a nose revolving with the propeller was used.

[The Trend of Military Aircraft Design. By C. M. Wright, M.E. *Aero World*, Oct 16, '16. 1720 words.]

The trend of aircraft design abroad has been toward simplicity, reliability, certainty and facility of manufacture, and proportional removal of the dangers of the personal equation. As a result we have wonderfully efficient types, possessed of inherent stability and splendid controllability. They are remarkable for their high speed and fast climb. Only three types seem to be in use, the light single-seater, armed, with a power plant about 120 h.p.; the two-place reconnaissance type with a 80 to 160 h.p. motor; and the heavy weight carriers with 140 to 230 h.p. This latter type may have one, two or more power units. The speed now is taken at an altitude of about 2000 meters, the altitude at which they are used and a speed of 90 miles per hour is satisfactory. Aerodynamically the trend has been toward machines having a larger chord and span for the upper wing. Greater cambers of planes, better location of the center of gravity and better setting of the horizontal empennage are features embodied. The loading limits are about 6.8 lbs. per sq. ft. for the main planes and a load of not to exceed 6 lbs. on other planes. The engineers abroad have produced low factored harmonious structures, light of weight, but so conceived and constructed that depreciation of the factor of safety is almost nil thruout the useful life of the machine. Light machines, that are amply strong, do not stall so easily, have a greater safe range the class that start to leave the ground. He progresses in this class from leaps to long straightaway flights, much more easily handled, suffer less abuse in actual service, and maintain their initial strength to a greater degree than the heavier types. Pilots state that the lighter machines have superior flying qualities and are generally more desirable; the fact that thousands are in use today seems to confirm the statement.

[Scientific Research Needed for Solution of Aeronautic Problems. By Lieut.-Col. G. O. Squier, U.S.A. *Aviation*, Dec 1, '16. 1450 words.]

The following are some of the present problems con-

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nected with the development of military aviation and aerostation:

1. *Aerodynamics:* This includes further research in dynamical laboratories, to obtain solutions for speed and direction of flow of air about geometric and aerotechnic forms; maps of the air currents of the upper atmosphere; full explanation of the phenomena of soaring; develop equations and laws of comparison of large aircraft and models; investigation of more direct and effective methods of securing a lift or thrust in the air; on consumption of fuel; and complete theory of the propeller.

2. *Engine Problems:* To obtain the fuel that will yield the most power for the least weight; investigation of solid fuels that can be converted into a liquid; to develop a better method of cooling engines at high temperatures; to obtain tubing that will resist vibration and deterioration; to develop a better covering for metal parts of the aeroplane; and to eliminate the noises connected with the engines of airplanes.

3. *Miscellaneous:* This includes the physiological effects of low density air at high altitudes on pilots; development of transparent wing covering of airplanes; development of light alloys for airplane construction; the structure of gusts, radio apparatus for communication between aircraft; development of bullet-proof gasoline tanks; to devise non-inflammable and protective clothing for aviators; to develop an instrument that will give the actual ground speed of aircraft.

4. *Physics of the air:* At the present time we have no evidence of vibrations in the air much greater than 40,000 to 60,000 cycles per second, but there is no reason to deny the possibility nor indeed the probability of vibrations of 100,000 to 200,000 or even a million cycles per second in the ordinary air we breathe. A detector should be developed to determine the existence or non-existence of such vibrations. The magnitude of the friction of the air against the surface of bodies moving thru it may absorb large amounts of energy. Thoro investigation should be carried along that line.

[Influence of War on Aeroplane Construction. By P. Béjeuhr, C.E. *Schweiz. Zeit. f. Art. u. Genie*, Mar, '16. 4000 words.]

(This is a transcript from *Dingler's Polytechnischen Journal.*)

It is no exaggeration to say that in one year of the present war, more has been done for aeroplane construction than would have been done in ten years of peace. In a general way, however, our ante-bellum experiences have served as a basis. The increased requirements in the load to be carried have brought about the substitution of the biplane for the monoplane. The great stability of the German "Tauben" was obtained at the price of speed and ability to climb. In fact, it was impossible to get them above a certain altitude. Whereas in the beginning of the war 1700 m. was considered a safe altitude, the progress made in the construction and use of anti-aircraft defenses soon raised this safety zone to 3000 and 4000 m. At the outbreak of the war it took the best planes from ¾ hr. to 1½ hrs. to make this climb; present airplanes are doing it in less than half that time.

At the beginning of the war the French in their desire to overcome German superiority in speed and climbing ability, sacrificed stability and solidity in construction. The French, however, soon realized the impossibility of developing an all-round type and were the first to organize their air service in squadrons equipped with special types for different purposes. The purposes for which airplanes were to be used were classified scouting, artillery observation, bombing, and combat. For each purpose a special type of airplane was developed.

In constructing all parts great simplicity and solidity have become of the utmost importance. They must be practically unbreakable. On the other hand, all mechanical appliances, especially the steering device, must be so designed as to require the minimum of power for their operation. In the construction of the fuselage and struts, the use of steel tubing is now becoming general, due principally to the fact that the supply of American spruce is now cut off. Wooden spars and struts vary in cross section, depending upon the forces acting upon them in the two co-ordinate directions. All struts and cables must be so designed that they are easily demountable.

To avoid ordinary rifle and machine gun fire aeroplanes must fly at an altitude of over 2000 m. Fixed anti-aircraft artillery should be avoided altogether. Even field guns are now dangerous due to the proficiency acquired by the gunners. When attacking aeroplanes, a series of shots is fired, the guns being laid just ahead of the aeroplane, thus establishing a danger zone which it can escape only with difficulty.

Artillery observation. Planes used for this purpose usually fly within their own lines. They should be able to reach an altitude of 2000 m. quickly so as to be secure against machine guns; small arms fire is not dangerous and defensive armor is not required. If attacked they must withdraw. Since their radius of action is small, the benzine supply need not be very large. For this reason these machines are light and equipped with relatively small motors.

Scouting aeroplanes. Durability and large radius of flight. Motor must therefore be powerful and supplies carried plentiful. Should be able to rise quickly to an altitude of 3000 m. Defense against hostile attacks lies in great speed. To attain this almost all protective armor is sacrificed. Neither do they carry defensive weapons. These machines are built to carry two persons, benzine supply, instruments, photographic apparatus. They attain a speed of 125 km. per hour, and can climb 2000 m. in 15 to 18 minutes.

Bombing aeroplanes. Requirements similar to the scouting aeroplane. In order to be able to carry a sufficient supply of bombs, they sacrifice somewhat their speed and climbing ability. When starting out on an expedition it therefore becomes necessary for them first to reach a high altitude behind their own

lines, then set out directly on their mission, and having dropped their bombs and thus regained most of their speed, to return quickly to their station. To compensate for loss of speed, they are protected against small-arms fire and equipped with a machine gun. They usually fly in squadrons and are accompanied by a combat aeroplane. Even if subjected to a counter-attack, a certain per cent. of the squadron will succeed in dropping their bombs. To assure this, the combat aeroplane will draw to itself any hostile aeroplanes, which will probably be in small numbers anyway. If the situation becomes critical, the bombing aeroplanes drop their bombs and also take up the fight. Since this machine is constructed primarily for bombing, the service of its machine gun is not always convenient. In the latest types the machine gun is fixed and fires thru the propeller. This is accomplished without damaging the propeller, either by providing the blades of the propeller with deflection plates or by synchronizing the machine gun with the rotation of the propeller. The person steering also operates the machine gun. The machine gun is not aimed but is fixed in position. The aeroplane flies head on toward its opponent and at the proper distance the machine gun is put in operation. Before landing, bombing planes must usually drop their unused bombs. As a matter of fact many bombing planes have been destroyed in an emergency landing from the explosion of their own bombs.

Combat aeroplanes are developing along two separate lines, either for pursuit or for battle. The real battle plane has not yet been fully developed. The general requirements are protective armor against machine gun and small-arms fire; great speed, climbing power, and ability to maneuver and turn quickly. This means great care in constructive details, balance, design of planes and a powerful motor. The radius of flight and therefore the amount of benzine carried need not be very great because most combats in which they engage take place near the front or near their stations. These aeroplanes usually carry two machine guns so as to be able to open a fire attack in any direction. They must have great ability to climb and to maneuver in order to gain the advantage of position. All these things require high motive power and the latest machines are equipped with two motors.

[The New German Airplane with Totally-Enclosed Body. *Sphere,* Feb 3, '17. 500 words. Illustrated.]

(From a description by M. Jean Gagorgette in *L'Aérophile.*)

The newest type of German biplane has an enclosed body, so that pilot and gunner-observer sit inside the fuselage. Thus the fuselage is deep. The top plane is attached to the top of the fuselage, and the lower plane to the bottom longerons of the body. There is only one interplane strut on each side. The wings are of about 36-foot span, and the machine has a 160 to 200-h.p. Mercédès engine. The speed is about 100 m. p. h., and the climbing power about 100 meters per minute.

The two seats are arranged tandem, the pilot in front. Plenty of windows furnish facilities for observation and steering. The body is elliptical in section. No armor is carried.

[Sand Load Tests on Wing of Curtiss Flying Boat H-12. By J. H. DeKlyn and G. E. Hawthorne, engineers of Curtiss Aeroplane Company. *Aviation,* Mar 1, '17. 1380 words. Illustrated.]

The sand tests were made according to the standard instructions of the British Admiralty on the wing of the *H-12* flying boat. This wing is 92 feet long and the longest wing ever tested in this country. The wing was supported for test by special jigs in an inverted position. The wing hinges were used in the usual manner. The load of sand to be supported was 28,113 lbs. This was determined by adding the net weight of the machine 5934 lbs., the useful load including pilot, passengers and petrol 2044 lbs., and the weight of the wings 767 lbs., and multiplying the total by the factor of safety 4. The upper plane carries 69% of the load or 19,400 lbs., and the lower plane the remainder or 8710 lbs. Subtracting the load carried by the engine section or 2300 lbs., the load on the side of the lower wing is 4355 lbs. and one side of the upper wing is 8550 lbs. The loads put on the wings were:

1. Bags of sand totaling the weight as above; loads on one hour.

2. Loose sand equal in weight to four times the required load. Corresponding to the load for minimum speed. Center of gravity 1/3 distance from leading edge.

3. Same as 2, only center of gravity ½ distance from leading edge. Corresponds to maximum speed.

4. Loose sand equal in weight to 5.9 times normal load, center of gravity ½ distance from leading edge.

5. A loading of 60 people averaging 150 lbs. each.

All deflections were measured, the bowing of spars, the stretch of cables and the deformation of the jig recorded. Test No. 1 caused maximum deflection of 3.5 inches at the tip of the top plane and tightened up all slack wires. No important deformities were noticed. Test No. 2 caused all drop wires to slack and solder to crack on some of the lift wires. Test No. 3 caused a rib to break and the struts at the front edge to bow perceptibly. The wing withstood the load specified by the Admiralty without permanent deflection or sign of failure.

[Air Resistance of Cylinder Combinations. By T. H. Huff. *Aviation,* June 1, '17. 1340 words. Illustrated.]

During the past year Messrs. T. Wong and T. Yu conducted the following investigation to determine the shielding effect of certain tandem wire or cylinder combination commonly met in airplane trussing. The work was supervised by Dr. Hunsaker at the Aerodynamical Laboratory of the Massachusetts Institute of Technology. Round wood rods of maple, turned to the nearest hundredth of an inch, were employed to represent the wires. A special apparatus was designed to support the models in a horizontal plane

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normal to the wind. The following investigations were recorded:

(1) The determination of the resistance of the supporting device alone and the precision of the alignment required.

(2) The resistance of single cylinders of different diameters subjected to a series of wind velocities.

(3) The resistance of two cylinders in tandem:

(a) The effect of the increase in the gap or space between two rods of equal diameter.

(b) The effect of variation in gap between two cylinders, the rear one being smaller in diameter than the front.

(4) Reduction to resistance caused by filling in the gaps between the tandem rods.

(a) Different gaps with equal diameter cylinders.

(b) Tapering board to represent filled-in gap with smaller wire in rear of tandem.

(1) Determination of the resistance of the supporting apparatus: an increased resistance of 8 per cent was observed for a 2 deg. change in alignment. (2) Resistance of a single cylinder: with the apparatus employed, the flow of air around the end of the test specimen was more or less restricted. (3) Resistance of cylinder combinations: (a) Cylinders of equal diameter with wiring spacing; specimens employed were two ½ in. diameter cylinders. The front cylinder was placed in the foremost position in the slotted T head, and the rear placed next to it, the smallest allowable spacing in this case being one diameter, distance measured from center to center of cylinders. (b) Cylinder of different diameter with varying spacing: the specimens were mounted and the adjustment varied as above, the rear cylinder, however, being of smaller diameter than the front. (4) Resistance of cylinder combination with filled in gap: (a) it was thought a reduction in resistance might be obtained by filling in the space or gap between the tandem rods to assimilate the practice of wrapping fabric or imbedding in wooden "stream lines" wires where they occur in pairs. (b) One specimen was tested to represent the 1:¾ ratio with a spacing of 4 diameters to ascertain if any marked improvement resulted from filling in the space of this type. The 1:¾ ratio was chosen since it would represent more closely possible practice. The length of all boards was 18 in., as in the previous tests. All specimens, excepting the tapering type, were tested with one edge, and then the other facing the wind, and the results averaged in order to reduce to a minimum all errors due to mounting and workmanship. The general trend is, in each case, a slight decrease in resistance between the spacing of 1 and 2 diameters to an average of 80 per cent of the resistance of a single wire, then a gradual increase in resistance as the spacing is progressively lengthened to 3½ or 4 diameters where the two wires have about 130 per cent of the resistance of a single wire. About 4 diameters the rate of increase drops off so that there is little advantage or disadvantage between 4 and 8 diameters spacing. The 1:1 ratio has an individual curve from 1 to 3 diameters. It does not, however, contradict our expectation from the other three cases, since it may readily be seen from the 1 diameter spacing of each that the resistance is progressively lowered as the ratio approaches unity, as

1:½ = 70 per cent of single cylinder
1:2-3 = 83 " " " " "
1:¾ = 72 " " " " "
1:1 = 40 " " " " "

The 1:1 ratio, as generally employed by manufactories to-day in the wing wire bracing, gives appreciably less resistance than the other three combinations for spacing less than 3 diameters, and only a small per cent more at greater spacing. In practice, it would be necessary to maintain the same wire strength, necessitating a larger front wire than used in the 1:1 ratio —thus a larger unit resistant—with the probable loss of any slight advantage anticipated from the tapering combinations.

Recommendations: (1) The usual practice of using wires of equal diameter where two wires are employed should be adhered to, as it is the best, both from resistance and strength considerations. (2) Unless the space between the wires is less than 2 diameters, the gap between them should be filled. Two-thirds of the resistance is thus saved.

[Six United States Army Wing Sections. By Captains Edgar S. Gorrell and H. S. Martin, U.S.A. *Aviation*, Apr 15, '17. 1200 words.]

These wing sections, developed by the Aviation Section of the Signal Corps, offer considerable interest both from an aerodynamical and a structural point of view. The U.S.A. 1 is a modification of the Clark aerofoil. By increasing the depth at the position of the rear spar, it was made structurally much more practical, the maximum lift was increased and the maximum lift-drift ratio only very slightly reduced. The U.S.A. 2 has the same upper surface as the R.A.F. 3, but the lower surface has been modified and deepened from a structural point of view. The U.S.A. 3 and U.S.A. 4 are both modifications of the U.S.A. 2. In the first section, the nose of a 30-inch chord has been moved forward ⅜-inch and the ordinates of the first fifth of the 30-inch chord spread out accordingly. In the U.S.A. 4, the nose of a 30-inch chord has been moved back ⅜-inch and the ordinates of the first fifth of the 30-inch chord crowded out accordingly. The U.S.A. 5 was skilfully developed from both structural and aerodynamic considerations, with very satisfactory results. The tests were conducted under the standard conditions. None of the wings may be said to be longitudinally stable, but none of them have a violent center of pressure motion within the usual range, and with modern non-lifting tail surfaces, no difficulty would be met in securing longitudinal stability.

It is noteworthy that the U.S.A. 4 has a higher maximum lift coefficient than almost any wing section tested, .00364, compared with .00347 of the R.A.F. 3. This wing would seem to be particularly suitable for very heavy machines, such as seaplanes.

Altho for small values of *Ky* and high speeds, the Eiffel 32 has better efficiency, U.S.A. 6, also with a higher maximum lift, would compare most favorably in a high speed machine with any French wing of which data have hitherto been published. For pursuit machines, the choice between U.S.A. 1 and 6 would be very close. U.S.A. 1 would give a better landing speed and U.S.A. 6 is slightly more efficient at low angles and high speeds. U.S.A. 2 and 3 would be good all round wings, apparently slightly better than the R.A.F. 6. An interesting feature of the series is the successful employment of heavy camber on upper and lower surfaces. It has been commonly accepted that heavy camber meant increase in lift with corresponding decrease in efficiency, while lightly cambered wings would give high efficiency but low lift. With skilful design, it is apparently possible to retain both good features. Tables are given showing the aerodynamic properties of each wing for various angles of incidence. Diagram showing cross sections of each wing included in article.

[The Large Aeroplane of the Future. *Army & Navy Gazette*, June 30 '17. 1500 words.]

But few large airplanes have been produced. The war has demanded such a large output of moderate-sized machines that the experimental work necessary for the development of large machines has not been possible.

The relative ease of handling large and small airplanes is as yet undetermined. Air gusts will unquestionably affect the large airplane less. War airplanes require maneuvering power and ready control which imposes great strain on the pilot. These qualities will not be required in the large airplane developed for commercial purposes.

The limiting size of airplanes is as yet a matter of theory and diametrically opposed opinions. It remains to be seen whether future progress in design will be limited to improving existing types.

The large airplane should be more reliable, on account of a multiplicity of power units, which would allow the operation of some while others are being repaired. From a structural point of view, the advantage in design is in favor of the large machine. It will not be exposed to the same strains as the small fighting type.

Some pilots maintain that the large and clumsy machine will always be at the mercy of the small quick climbing, easily maneuvered scout, but others are positive that the superior armament of the large airplane will give it the advantage.

For long flights, the large airplane is bound to come into its own. Only such a machine can carry the fuel, can have the reliability of multiple motive power, and can carry a crew sufficient to afford the reliefs necessary in long flights. Floating fuel depots would reduce the weight necessary to be carried, but the small airplane could not carry the floats necessary to enable it to alight on the surface of the sea.

[Course in Aerodynamics and Aeroplane Design. By Alex. Klemin, and T. H. Huff, Instructors of Aeronautics, Mass. Institute of Technology. *Aviation*, July 1, '17. 1500 words. Illustrated.]

Computation of Strength Members and General Layout of Body—In designing tension members for the body, no feature is of greater importance than the choice of terminal fastenings which will permit the development of as large a percentage as possible of the true strength of the wire or other tension member. The main points to be considered in dealing with terminal connections are: (1) The efficiency, as mentioned above; (2) Quickness and ease of manufacture; (3) The possibility of easy and efficient repair or replacement in the field; (4) Reliability; (5) The possibilities of defects due to the use of acids and solder, overheating, imperfect bends, flattening of wires on bends or unskillful handling of the material in the field.

Extended tests on terminal connections of all types have been made by J. A. Roebling's Sons Co. The first series of tests related to hard drawn aviator-wire. The form of terminal consisting of a ferrule made from a coil of wire, thru which the wire is passed and then doubled back on itself, gave very poor and uneven results, the efficiency varying from 60 to 75 per cent. The next type of terminal tested was similar to the last, but was dipped in solder after being made up. The efficiencies obtained ran from 60 to 90 per cent, with an average of 80 per cent. These values are surprisingly low, and indicate probable damage of the wire by overheating in the process of soldering. In the Roebling tests, the best results were secured by the use of tapered ferrules, winding a coil of wire into the form of a slightly flattened cone instead of a flattened cylinder, in conjunction with wedges designed to increase the friction between the stay and the ferrule as the pull increased. The efficiencies obtained with terminals where no solder is used were very uniform, ranging from 92 to 96 per cent, with an average of 94 per cent. Such a terminal, altho necessarily somewhat complex, has marked advantages. Both strands and cord can be spliced with excellent results if the work is done by an expert rigger. Roebling's tests indicate an efficiency of from 80 to 85 per cent for aviator cord with spliced and served terminals, and from 90 to 100 per cent, the highest values corresponding to the smallest wire sizes, for 19-wire aviator strand. The latest specification issued by the Government calls for an overall factor of ten, but this relates to pursuit machines, which are to be flown by skilled pilots only, and in which the factor of safety is purposely kept low in order to make possible a better performance, and hence a higher degree of military safety. In the case of those portions of the longerons which are curved to a considerable extent between struts, the factors of safety should be considerably increased, as a strut which has even the slightest sign of initial curvature, will support much less load than one which is perfectly straight.

—History

[Bishop Wilkins On Submarines and Aeroplanes in 1648. By J. F. Fuller, F.S.A. *United Service Magazine*, June, '17. 2800 words.]

AERONAUTICS—Continued

(A curious account of the possibilities of submarine navigation and the art of flying, from the book written by J. Wilkins, a Bishop of Chester, a D.D. of Cambridge, and Master of Trinity there, in 1648.)

—Instruction and Training

[How France Trains Pilot Aviators. By a Sergeant of the American Escadrille at Verdun. *Aviation,* Nov 1, '16. 1900 words. Illustrated.]

France now has thousands of men training to become military aviators and the flying schools are turning out pilots at an astounding rate. In training pupils on the large biplanes, they go up in a dual control machine with the instructor. His instruction is gradual, from not being allowed to handle any controls on his first trip to the time when he has all controls and makes the start and the landing. The training for a small fast pursuit machine is quite different, as the airman is always alone in his machine and must face all of his problems without assistance. The training is started on a low powered machine, with small wings that is strongly built but has not power enough to leave the ground. Due to its high speed it is very hard to keep this machine in a straight line and it frequently goes over on its back or side. The same instruction is carried on in two other types, each one faster than the first but none being able to leave the ground. When the student can steer with his feet and make a perfectly straight line, he is put into the class that start to leave the ground. He progresses in this class from leaps to long straightaway flights, involving landings, and finally to flights of over two or three miles in a straightaway. This gives the student practice in combating air currents and also confidence. The next instruction is in turning, and starts with wide turns and gradually progresses until the pupil is making sharp figure eights. The final instruction includes spirals and landings with and without power. In order to get his military license, the pupil must now make three cross country trips, two of which are straight line flights and return, and the third a triangle flight and also ascend to an altitude of 7000 feet or over. His instruction after that is on higher powered and faster machines until he finally learns to make a landing from about eight thousand feet with his motor shut off in the fast Morane monoplane. After all of the flying tests he is sent to the school of combat where he learns to fire the machine gun, how to fight singly and in fleet formation. He is taught to loop, to slide on his wings and tail, to go into corkscrews, and to get out of them. He is then held in the reserve and finally sent to the front.

[How an Aviator is Made. By X. *L'Illustration,* Feb 10, '17. 2000 words. Illustrations.]

Great credit is due to the organizers of the aviation schools, because they did not have much to work with. In the spring of 1916 our [French] schools turned out 35 to 40 aviators a day. And we are doing much better since. Without taking account of the new centers, each establishment has become four times as great since a year ago. The proportion of fatal accidents was 8 to 10 per cent. before the war; now this proportion at the schools is about 1 to 1½ per cent., thanks to the prudence used in the instruction of the pupils and also to the present quality of our machines.

* * * * * *

All requests, after approval by military channels, go to the Ministry of War. The candidate undergoes a medical examination and, if he passes it, he is sent to Dijon. There he undergoes a second and more thoro medical examination that tests his physical faculties (heart, sight, brain, speed of reflexes, vertigo, endurance of electric discharges, etc.). He will spend about a month in following theoretical courses on the different motors, in the study and construction of machines, phenomena of the air, etc. At the end of the course, he takes an examination and may elect the type of machine he desires to work with. The school for the Caudron, Juvisy and Buc machines is at Tours; for the Farman machine at Chartres and Etampes; for the Voisin at Avord and Ambérieu; for the rapid machine at Pau. Our neophyte arrives at one of these schools with a modest scientific baggage and many illusions. After a third medical inspection, still more severe, he is lodged comfortably and begins the practical work.

After a few flights as a passenger, his instruction begins in an apparatus with double control; an experienced pilot, seated behind the novice, warns him of errors committed and rectifies the maneuver.

First, he drives alone a machine with practically no wings; he tries making straight lines on the ground. This machine is commonly known as the "penguin," or the bull. The use of this machine gives rise to amusing incidents, and the comrades of the service are not infrequently terrorized by seeing him rushing at them with all the speed of his 50 horse-power.

Finally, at the end of a month or two, the student arrives at the solemn moment of his first flight alone. Serious advice is repeated a hundred times: "Don't get nervous, and control yourself. Fasten yourself in well. . . . Now listen, if your motor doesn't work well at the start, stop. Don't go up too fast," etc., etc.

Finally, he starts. He pulls his "broomstick" with eyes fixed and limbs tense. He rolls 50 meters and leaves the ground. First impression: insecurity. He dips towards the ground at full speed, sees the earth, goes back up energetically, inclines to the right and left to avoid imaginary currents and turns like a frightened sheep, causing laughter and cries of terror from his comrades on the ground. He grazes the foliage of the poplars along the road and the wall of a farm, frightens a gate-tender and then, having avoided luckily some telegraph wires, he goes up and up and lacks the courage to come down.

In the mean time, below, the center becomes smaller, the hangars seem toy cubes, the group of comrades disappear little by little. However, he has to come back. Finally, he decides to cut off his gas and makes a terrifying descent, breaking a wheel or crushing a wing. . . .

But the first impression has passed; confidence has come. The second flight will be better; the third almost perfect.

"You see," I heard an old pilot tell a beginner, "flying, after all, is very simple. They give you a machine made for that purpose. You get in and sit down. You press a button, saying, 'Contact,' and the machine starts of itself. You push on the handle, the machine rolls. You haven't anything more to do. . . . To come down, you cut off the gas, the machine goes toward the ground; you straighten, close your eyes and count up to ten, and it's over. You have landed! It is very simple, as you see!"

* * * * * *

A month later, our aviator is ready to pass the tests to qualify him as a military aviator: an hour at 2000 meters, and three different triangles, 100 kilometers on a side, and, besides, a spiral. He has automatically won his corporal's stripes and may proudly fasten to his collar the winged stars.

Four days pass—time to get himself an outfit made to his fancy—and he is off to an advance school, Châteauroux, Avord or Ambérieu, where he will practice for a month with a war machine. Then, if he shows himself to be an "ace," he will be sent to Pau, the school of the pursuing flyers. He will try several different kinds of machines, and may finally get a "Bébé," the object of his dreams, and be sent with it to the Cazaux School of aerial fire. This school is quite remarkable for its equipment. Firing is done there with all arms, from pistol to cannon, including the most varied types of machine guns. They fire in airplanes, in balloons, in automobiles, at fixed, moving and disappearing targets. Men like Guynemer, Navarre, Nungesser, have been there. A month's course at Cazaux (on the Gulf of Gascony), and the pilot joins the general reserve at the Plessis-Belleville, where each section of different machines works at its final training before leaving for the front. Practice is held in bombardment, photography, reconnaissance. Finally, our eaglet goes and gets at le Bourget the new machine and equipment which are issued to him and flies towards the front.

One meets in the instruction centers the most diverse and curious types. Officers of all grades and arms fraternize with the student non-commissioned officers and privates. Some are observers who wish to finish the campaign as pilots; others are former mechanicians who are ambitious. These two classes generally make the best aviators. Numerous are the cavalrymen, who, disappointed by trench warfare, have taken up aviation.

All the pupils at the schools, in spite of the rigid conditions of their entrance, do not necessarily come out as pilots. Certain ones, doubting their own coolness, relinquish piloting voluntarily and go back to being mechanicians or observers. Others, in the course of their instruction or after too many accidents, are judged unfit.

And in spite of the difficulties, the dangers inherent to the business, the losses at the front, the accidents at the rear, applications are more numerous now than ever before.

[Some Psychological Aspects of Aeronautics. By Dr. Harold E. Burtt. *Aviation*, Apr, '17. 1400 words.]

In studies of both the practical psychological aspects of aviation and the theoretical problems of the sense of equilibrium a complicated apparatus is employed to produce the desired changes in equilibrium. The subject on whom the experiments are performed sits on a chair upon a platform three feet square. This platform rocks on a rounded plate a foot below its center, and is held in a horizontal position by heavy spiral springs attached from its four corners to the floor. Wire ropes from the corners pass thru pulleys directly below and thence thru other pulleys to a sprocket actuated by a crank and worm gear. By connecting the proper ropes and turning the crank, the subject can be tipped from a horizontal position in various directions and at various rates. Connections were arranged so that a circuit was closed momentarily the instant the platform began to tip, and was closed a second time by the subject with a telegraph key the instant he was certain as to the direction in which he was being tilted. Thus by giving many trials and averaging reaction times, the delicacy of perception of changes of equilibrium in the different directions could be determined. The trials were given in four directions—left, right, front and back—in irregular orders and at various rates of movement, with due regard to such factors as practice, fatigue, space and time errors, suggestion, and the like.

This sense of equilibrium arises mainly from small organs in the inner ear. Adjoining the organ of hearing are three semi-circular canals filled with a watery fluid. These canals are arranged in three different planes, and as the fluid in one or more of them changes its position with the rotation of the head, it stimulates delicate nerve endings at certain points in the walls of the canals. The average efficiency for detection of roll (lateral) as contrasted with that for pitch (longitudinal) on a given hour were compared and thrown into per cents of superiority of the former. This average shows that the lateral tilting (roll) was detected approximately 25 per cent more readily than the longitudinal (pitch). In the above results no differentiation was made between backward and forward or between left and right, but merely one average determined for longitudinal and another for lateral motion. In some supplementary trials the apparatus was modified to give a much more rapid motion. These conditions seemed quite analogous to conditions in an airplane, giving a quick motion with a negative acceleration. The possible practical implication is that the aviator cannot detect a pitch of his machine as readily as a roll, and he will thus be slower in making the proper movements to correct the former. Hence in selection or arrangements of controls, if those for one direction are to be more readily manipulated or available, such should be used for longitudinal control to compensate the aviator's natural slowness in detecting a tilting in that direction.

AERONAUTICS—Continued

United States

[The Pensacola Flying School. *Aviation*, Apr, '17. 1078 words.]

The navy flying school and station are located at Pensacola, Fla., where there is an excellent landlocked bay about five miles wide and fifteen miles long, which allows plenty of room for flying, over smooth water. Within two years Pensacola has developed from an abandoned navy yard to a well equipped and very busy aeronautic station. Concrete hangars for the accommodation of thirty-six airplanes are under construction and all buildings are receiving equipment which is peculiar to the needs of aviation. A branch of aeronautics entirely new, so far as our navy is concerned, is being taken up with the purchase of a small dirigible, a captive kite observation balloon and a free balloon. The General Board of the navy reported that experience in Europe showed that an aviator should not be over thirty years of age. Medical observers have proved that flying places more than the normal load on the nervous system, that a normal blood pressure is important and that perfect eyesight is necessary in order to judge short distances accurately while moving at high speeds. An aviator who becomes startled or "rattled" simply courts disaster by flying. When the student aviator reports for duty at the navy aeronautic station one of the instructors takes him for a "joy ride," just to show how it feels to fly. He is then required to provide himself with such textbooks as the commandant directs. The student is required to master all the subjects thoroly, and close application is necessary to pass the monthly written examinations. Should the student fail to pass these examinations, he is detached from aviation duty. As often as weather and other conditions permit, the flying instructor takes his pupil for short flights, gradually allowing him to handle the controls as he becomes more and more at home and develops his "air feel." The average student will require between ten and twenty hours before being allowed to try it alone, and this time will be distributed thru two or three months. When the instructor is satisfied that the student has developed his "air feel" and some experience, he allows him to begin his elementary flying. When the student has passed all of his practical and theoretical examinations and his flying instruction is finished, he is allowed to take his test for a naval aviator's certificate. The test comprises the following: Climb to an altitude of 10,000 feet as shown by the recording barograph and glide to a normal landing, without porpoising, within 200 feet of a mark previously designated by the board. Make a spiral glide from an altitude of 3000 feet, and land without porpoising within 200 feet of a given mark previously designated by the board. Make a landing in a seaway where height of waves is at least four feet without damage to any part of the seaplane. Make a straight course and return between two objects not less than five miles apart in a wind not less than 25 miles per hour. Make a scouting flight over the open sea to a vessel that has been stationed at a designated bearing at a distance of 100 miles and return to the starting point. Demonstrate to the satisfaction of the board ability to fly in very bad weather. Start a flight from the catapult after personally making all adjustments for its operation. The student is then pronounced a full-fledged aviator.

[Synopsis of the Course of Training at United States Army Balloon School. *Flying*, June, '17. 700 words.]

The aerostatic side of aerial preparedness is beginning to look encouraging. Major Charles de F. Chandler, the veteran balloon expert, is in charge of this branch of the service in the Army and is ably assisted by Captain Frank Purdy Lahm, who is in charge of the Balloon station at Fort Omaha, Nebraska, and A. Leo Stevens, who is the civilian advisor, both deans of American ballooning. The course of training will be both practical and theoretical, so arranged that the practical instruction will have preference at all times when weather conditions are suitable. Whenever high winds or rain interfere with the outdoor training the class room instruction will be held and will consist principally of conferences. The instructor will cover the subject thoroly and students are expected to ask questions and join freely in discussion. Practical instruction in the measurement of specific gravity of gases, testing and adjustment of instruments and similar laboratory indoor work will be conducted when weather conditions outside are unfavorable. Practical instruction will include the methods of generating hydrogen; inflating and balancing balloons, and the repairs and tests of balloon fabrics and cordage; the deflation of balloons; and motor truck operation and maintenance. Theoretical instruction includes conferences on transportation; organization and equipment of balloon companies; balloon construction in all its details, including the size, type, shape, design, and manufacture; strength and weights of the various parts; kind, specific gravity, and different methods of production of hydrogen; description and use of various indicating and recording meteorological instruments, such as barometers, thermometers, hygrometers and anemometers; the movement of the atmosphere, cloud formations, tornadoes and cyclones; wind velocity, and the use, construction, and general principles of dirigible balloons.

[The Government's Plans for Training Military Aviators. By Howard E. Coffin, Chairman, Aircraft Production Board of the United States. *Flying*, June, '17. 909 words. Illustrated.]

America's aviation program is under way. Three of the great aviation fields which the War Department has planned are actually under construction; cadets are now training at the preliminary aviation schools established in the six representative engineering colleges and universities chosen for the work. Instruction of about 500 aviators will begin not later than Aug 1. America is responsible for the invention of both the submarine and the airplane. It is for us to

show that we can yet surpass both our enemies and the Allies in the development of the two great mechanical inventions for which we ourselves are responsible. We believe that we are making progress in our air program, and we intend to increase rather than diminish speed as we go forward. When America's new airmen leave the American fields at the end of their four months' training, they will embark for France. On French soil, under French instructors and with French machines, they will complete their preparation for actual work at the front. The buildings will be constructed and the field prepared by an American contracting firm. Thousands of men are now engaged in the preparation of the aviation fields at Dayton, Ohio; Detroit, Mich., and Champagne, Ill. Aug 1 is expected to be the latest possible date by which they will be completed.

It is just possible that we cannot get a full equipment of airplanes within the time, but we shall have enough to get a large part of the men in the air, and we shall not be seriously handicapped the first few weeks if we do not have our full quota of planes. The original Wright hangar placed on a modest tract of 86 acres, which constituted the Wright experimental field, is set within the boundaries of the big, new government field. The Dayton field is the largest of the new fields. It is 2500 acres in area. The hangars will house 144 airplanes, and 300 cadet students can be trained there at a time. The government is engaged now in investigating locations for the six two-squadron fields, the sites for some of which have not yet been chosen.

[United States Acquires Aviation Field in France. *Official Bulletin*, June 4, '17. 630 words. Quoted in part.]

The Council of National Defense authorizes the following:

The Aircraft Production Board has announced that three of the aviation fields which the War Department has planned are actually under construction; that cadets are now in training at the preliminary aviation schools established in the six representative engineering colleges and universities chosen for the work; that training planes will be ready for the aviation fields when they are completed, and that instruction of about 500 aviators will begin not later than July 20.

"France and Great Britain have made it plain again and again that they expect aircraft and aviators to be one of America's greatest contributions to success in the war." Howard E. Coffin, chairman of the board, said: "The Government can now say that it is actually embarked on the task of overcoming its present deficiency in military aviation. We believe that the outlook promises a quick development of the latent air resources of America which may be unprecedented in the military history of the world.

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The board announces that the Government has not only rushed its plans for the completion of its American fields, but that a site has already been selected, contracts have been let, and preparations for construction are under way for a duplication of the American standard two-squadron field to be prepared in France for the first aviators graduated from the American fields. As the new airmen leave the American fields at the end of their four months' training they will fly to the Atlantic coast and embark for France. On French soil, under French instructors and with French machines, they will complete their preparation for actual work at the front.

This American field in France will be entirely a product of American brains and American energy. The buildings will be constructed and the field prepared by an American contracting firm and it will be an exact model of the aviation fields which the American Government is now constructing in the United States. The material for its construction will be shipped to France from America. Thousands of men are now engaged in the preparation of the aviation fields at Dayton, Ohio; Detroit, Mich.; and Champagne, Ill. The Government has made them emergency projects and nothing is being permitted to delay their rapid construction. Buildings are being erected under expert supervision; materials are being rushed to them from the nearest available sources of supply, and July 20 is expected to be the latest possible date within which they will be completed. The work on these is being carried on separately and will in no way interfere with the construction of new Army cantonments.

"It may be a hard pull to get training planes enough for all the cadets from the universities who will be ready for work in these aviation camps when the camps themselves are completed," Mr. Coffin said. "We expect to have them none the less. It is just possible that we cannot get a full equipment of airplanes within the time, but we shall have enough to get a large part of the men in the air, and we shall not be seriously handicapped the first few weeks if we do not have our full quota of planes."

[Medical and Physical Tests for Aviators. *Aerial Age Weekly*, Aug 6, '17. 2500 words. Illustrated.]

It has long been recognized that a recruit for the active branches of the Air Service should possess special physical qualities and aptitudes, in default of which he is unlikely to reach the required state of efficiency. Candidates for the French Air Service have first to pass the usual military medical test applied to all branches of the army. In addition they have to pass a far more severe examination. Those who fail in any respect are rejected but it is interesting to note that ordinary physical disabilities which would cause a man to be rejected for the other branches of the Army form no bar to a candidate's acceptance for the aerial arm, and justly so; for there are several one-legged aviators who possess a fine military record. Candidates must possess, in addition to complying with the ordinary medical standard: (1) Normal vision of each eye, (2) Correct color vision, (3) Normal auditory powers and soundness of the middle ear, particularly with regard to the sense of balance, (4) Perfect fitness of the respiratory and circulatory systems. The

AERONAUTICS—Continued

heart must be in good enough condition so as not to provoke attacks of faintness, and the lungs able to withstand variations in atmospheric pressure. Good sight and hearing are of primary importance, altho there are exceptional cases on record of short-sighted men who are good aviators. The sense of hearing enables a pilot to detect any variation in the rhythmic beat of his engine, and thus to control it. A third sense, that of touch, is also of considerable importance, tho its possession cannot be localized in any specific organ of the human body, and is therefore more difficult to determine. The good pilot is he who, the most quickly informed by his senses, responds to them as quickly as possible, whose psychomotive reactions, take the least time. Training and experience may improve these reflex actions, and shorten their duration, especially so by transforming, by dint of repetition until habit is acquired, into subconscious and reflex movements, actions which formerly required the intervention of the brain—that is of conscious thought and the will. It becomes important to determine in advance whether a man's nervous reactions are too slow or too uneven to enable him to become the highly-skilled aviator required for the present conditions of warfare. The instrument used to measure the time of psycho-motive reactions is the d'Arsonval chronometer. This instrument has a dial, split up into one hundred divisions, across which travels a needle, actuated by clockwork for ten minutes continuously, at a constant speed of one revolution per second.

For the purpose of measuring the lag of visual reflexes the candidate is seated before the dial, push-button in his hand and told to press the button the moment the needle stops. The time taken by his visual reaction is measured by the number of divisions equivalent to 1-100th of a second by the needle in motion. The effect of sudden and violent emotions is perceptible in the cardiac respiratory rhythms and in action of the vaso-motor nerves. For this purpose a pneumograph is fixed on the thorax of the candidate and held in position by a tape passing around the chest; in one of his hands he holds a Hallion and Comte pressbutton, and in the other hand he holds a Verdin recorder, which reveals trembling. Thus are recorded: (1) respiratory rythm; (2) capillary circulation; (3) trembling. Thus are measured the *emotional* reflexes—in other words—the coolness and self-command of a candidate. For this purpose the examiner usually fires a revolver unexpectedly close to the face of the candidate. On comparing the graphs of our best-known pilots Drs. Camus and Nepper have found that their psychomotive reactions are exceptionally quick and their degree of "emotionality" distinctly slight. The practical value of the system may be gauged from the fact that thru its means from 25 per cent to 30 per cent of the candidates for the Air Services have been definitely rejected without further ado.

[How Army Aviators Are Trained. *Air Service Jour.*, Sept 27, '17. 1300 words.]

The objects of the schools of military aeronautics are:

1. To teach candidates their military duties and develop soldierly qualities.
2. To eliminate those who are mentally or morally unfitted to become flying officers.
3. To give necessary preliminary training in the use of the machine gun, wireless telegraphy, the operation and care of aeronautical engines, assembling and care of airplanes, principles of aerial tactics, co-operation with other branches of the service and the fundamental principles of cross country and general flying.

The candidates at the ground schools are organized as a regiment of two wings, divided into three and five squadrons respectively. Each squadron consists of the members of one class divided into three flights. Acting regimental wing, squadron and flight officers and non-commissioned officers are temporarily appointed.

The discipline is very strict. Calisthenics and infantry drill are required daily in addition to the course in technical study. Classes are sent to the schools of military aeronautics each Saturday and graduate after eight or nine weeks.

The course of eight weeks is divided into a junior wing of three weeks and a senior wing of five weeks. The work of the junior wing consists of intensive training in military discipline and drill, accompanied by a daily lecture on some military topic, daily instruction in the use of the machine gun and in wireless telegraphy. The work of the senior wing includes theoretical and practical instruction in military aeronautics.

At the end of the ground school course an examination is held to eliminate those not competent to go to the flying school. Those so eliminated are either discharged or allowed to repeat examinations.

The length of time required at the flying school depends upon the ability of the candidate as well as his previous experience. Instruction in machine guns, signaling, aerial tactics, etc., is continued as far as practicable.

[The Present Practice of Accepting and Training Aviators.—U. S. Army Air Service. From the Intelligence Section, Air Division, S. C. *Flying*, Oct, '17. 1300 words. Illustrated.]

Candidates for commission as flying officers in the Aviation Section must be at least ninenteen years old and preferably not over thirty, altho in exceptional cases older men may be accepted. As the flying officer is not an "aerial chauffeur" or exhibition flyer but a twentieth century cavalry officer mounted on Pegasus, it is obvious that candidates must be mentally alert and have well disciplined minds and bodies. The period of training covers courses at the Schools of Military Aeronautics (ground schools) and at the Aviation or Flying Schools up to the time when having passed the tests for a Reserve Military Aviator or Junior Military Aviator as required by the Chief Signal Officer, they are commissioned. The candidate can be discharged at any time during his course of training by reason of failure to pass tests or examinations.

For purposes of administration, drill and discipline, candidates are organized at each School of Military Aeronautics into a regiment of two wings, divided into three or more squadrons. Candidates live in barracks and eat at a regular mess at which they pay board. As far as practicable the system of discipline follows that at West Point. The course of study ordinarily lasts eight weeks. No candidate will be sent to a flying school who has not passed all of his final examinations in the ground school. Graduates of the ground schools are sent to aviation schools located in various parts of the United States and in the territories of our Allies. Some men pass their R.M.A. tests and qualify for their commission at the end of one month others require longer.

[Note. *Army & Navy Jour.*, Nov 4, '16. 400 words.]

The Signal Corps has taken up the aviation personnel problem. A school for training aviator instructors has been established at Mineola, Long Island, and another will shortly be established at Omaha, Neb. Student instructors will be paid $100 per month, and the maximum pay of experienced chief instructors will be $6000 a year. This ought to secure the services of some of the best civilian flyers.

[Aviation Notes. *Army & Navy Jour.*, Nov 25, '16. 200 words.]

The course for aviation students at the Signal Corps Aviation School lasts four months. In addition to instruction in flying, a student receives a three weeks' course in each of the following: theoretical instruction in areonautical engineering, practical instruction in construction and repair of airplanes, motors and motor vehicles. Students are required to qualify in telegraphy by sending and receiving at the rate of fifteen words per minute. They are given a short course in the operation of motorcycles. Text-books, Dyke's "Automobile and Gasoline Engine Encyclopedia," Milham's "Meteorology," and Loening's "Military Aeroplanes."

—Instrumental Equipment for

[Efficient Instrument Illumination for Military Night Fliers. By A. G. Hamlin. *Aviation,* Oct 1, '16. 1320 words.]

A night pilot has to be able to read his instruments every moment or his safety is jeopardized, and in addition he must keep out of the enemy's lines. At the present time most machines are equipped with electrically lighted instruments and in addition the pilot has a flash light. This extra weight can be eliminated by using instruments self-illuminated with a radium compound. Other kinds of luminous paints are made, but they are all more or less unsatisfactory, as they lose their luminous properties very quickly. Radium, on the other hand, will last for seventeen hundred years; and the radium compound made up with zinc sulphide will last long enough for all practical purposes, the exact time varying between five and thirty years. Luminous compasses have proven their worth to aviation, and it is hoped that all instruments will be made luminous without further loss of time as the safety of the military aviator depends on it.

[Aerial Navigation Over Water. By Elmer A. Sperry. *Flying,* Apr, '17. 2780 words. Illustrated.]

The magnetic compass is unreliable on ships due to the great masses of steel. The methods of checking the magnetic compass depend upon observations which fail usually just as they are most needed. This shows the desirability of an instrument of precision that will function as a compass. The adaptation of the gyroscope is found to fulfill this satisfactorily. When a magnetic compass is used on an airplane, and the machine is even moderately banked, and persists in such a position for an appreciable period, the error is found to be of such magnitude as to render the compass useless, in some instances amounting to 360 degrees. The compass, to be reliable, must be of the so-called liquid type, but after spiraling and making two or three turns the liquid is found to take up the swiveling motion, carrying the card with it, round and round. The magnetic compass is not an entirely useless instrument for aircraft, but it should be understood by the aviator, and not relied upon when conditions are such that it is impossible for it to function. This condition is so aggravating that the United States Navy is ordering gyroscopic compasses for airplanes. By extreme refinement in execution and design, the weight can be reduced to twenty or thirty pounds. If an airplane is trying to go on a due north course, but the air itself is in motion towards the east, with the velocity equal to that of the aircraft, the craft itself passes over the earth in a northeasterly direction. The amount he is drifting off his real course can be obtained by the use of an instrument called the drift indicator.

The principle of this instrument is the placing of a cross-hair stretched across the tube or telescope in the line of motion formed by the objects on the ground. The telescope is furnished with a stationary scale. By taking readings on this scale with the pointer on the tube opposite the cross-hair it becomes easy to determine the angle between the streamlines and the major axis of the aircraft, since the latter always lies in the apparent direction of flight. The determination of such an angle as this is extremely useful, as it at once gives the aviator a clue as to what change to make in his course so that his direction of flight is such as to neutralize the drift of the medium thru which he is flying, his actual course thus being brought into harmony with the direction required to reach his destination. A pilot, working alone, has enough cares without the average one of worrying whether the compass has been accurately synchronized with the drift indicator, and whether the direction of the adjustment is also correct. By coupling them (compass and drift set) together, mechanically, they are automatically synchronized at all times. This combined instrument is called the synchronized drift set.

This arrangement automatically introduces all of the deviations in the course to correct his drift, and is found to save much valuable time and fuel, and to allow the pilot to reach his destination by a direct meridional course. In flying over water it is always wise to note the direction of the wind before starting,

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and also something as to the length of the wave; that is, the distance from wave crest to wave crest. In leaving the surface of the water, the aneroid should be adjusted on zero. This should also be done whenever the plane is brought close to the surface, thus eliminating the effects of changes in barometer in determining the actual heights. The following rules can be applied to aerial navigation:

1. Note on which side of the keel line or longitudinal axis of the aircraft lies the actual or true course.

2. Note closely the apparent alignment of the wave crests while the aircraft is being maintained on its course.

3. Note the relative angle between the wave crests and the keel line, or the alignment of the adjustable lubber line.

With these observations well in hand, the following deductions can be made:

If the crests lie within the angle between the keel line and the drift line, then the real speed is approximately identical with the anemometer speed.

If the aft ends of the crest be toward the drift side, then the actual speed over the earth's surface is always greater than the anemometer speed.

If the aft ends of the crest are away from the drift side to a greater extent than is the true course angle, then the actual speed is smaller than the anemometer speed.

There are a number of other interesting aids to navigation of aircraft, such as gyroscopic base lines, artificial horizons, banking indicators, angle of incidence indicators, and the like, but their uses are apparent.

[Aids for the Aerial Navigator. *Army & Navy Gazette*, July 28, '17. 800 words.]

The aerial navigator requires for his use certain instruments in addition to the magnetic compass, especially when unable to steer by landmarks. One of these is the Sperry synchronized drift-set which comprises a compass and a specially designed telescope. The latter has a number of parallel hairs across the field of vision, by means of which it can be so turned that terrestrial objects appear to follow the hairs. The telescope is connected to the compass so that the latter automatically corrects for drift.

Another device available is the spring automatic pilot, consisting of a generator, sensitive gyro units for correction, and servomotors which act on the airplane controls. Between them they maintain the machine in a fixed horizontal plane and a given directional line, thus enabling the pilot to take his hands off the controls, and enabling the single scout to do the work of observer or photographer on occasion.

Military aviation requires easy maneuvering qualities in airplanes and almost acrobatic skill on the part of pilots. These will be unnecessary in aerial navigation in time of peace, but the experience gained in this war will be of great value in the future. A great deal has been learnd about meteorology, and the large bombing machines may be the forerunners of the future mail and passenger airplanes.

—Landing

[Emergency Landings in Cross-Country Flying. By Capt. Joseph E. Carberry. *Aviation*, Apr 15, '17. 1182 words.]

The specter of forced landing in cross-country flying, ever present to the disillusioned pilot of experience, often seems to be entirely disregarded by the younger generation of aviators. It is assumed that every aviator in planning a cross-country flight will first acquaint himself with the character of the terrain he proposes to traverse, that he will select his route, with regard to the possible emergency of a forced landing, that he is thoroly familiar with the flying characteristics of his airplane. By careful routing, flights may be made with reasonable security over apparently impossible country. The landing field should be of sufficient size and of such surface as to permit of easy entry and exit. If possible select several alternative landing places. Remember that fields to right and left of your line of flight can be reached as easily as those directly in that line. Be wary of landing in the immediate vicinity of bodies of water, as the neighboring ground often slopes abruptly. In inspecting your prospective landing fields, keep the sun at your back. A close observation of smoke along the course will be invaluable. If there be a strong surface wind, indicated by these and other signs, select possible landing fields with long axes in the direction of the wind. Always land into the wind whenever possible. In gliding down to enter a field against a strong head wind, do not turn away from the area in view by spiraling at low altitudes, but make "S" glides instead. At least the final 500 feet should be so timed that you may enter the field selected by a right-handed turn. Particular attention should be paid in practice flights to slow landings. This is essential when landing is to be made in heavy plowed fields, in snow or water. Endeavor to make your glide at as moderate an angle as possible. Above all, keep your airplane under control until the very last. Strict adherence to this rule will often result in landing without damage to the person of the pilot or his passenger.

—Legal Regulation of

[Making Laws for Aerial Navigation. By Bernard H. Sandler, Member Law Committee, Aero Club of America. *Flying*, May, '17. 2280 words. Illustrated.]

Laws for aerial navigation can be divided into three classes as follows: (1) International laws; (2) Federal or interstate laws; (3) Traffic laws. The first Pan-American Aeronautic Conference held at Santiago, Chile, recommended legislating on aerial locomotion according to the following principles:

1. All space higher than the height which may be utilized by the proprietor of the ground underneath shall be declared public property for public use.

2. The navigation in the space above the American continent, and within adjacent oceans must be free to all Americans and foreigners domiciled in America, with no other restrictions than those which the laws of American countries may dictate.

3. The nations have the sovereign right to the space

dominated by these territories. Private airplanes belonging to the citizens and to local inhabitants of a country have the right of passage thru the space over other nations.

4. Every airplane shall have a nationality; public aircraft, that of the nation to which they belong; private aircraft, that of its proprietor.

5. All airplanes shall carry a distinct emblem of their nationality, after having been thus correspondingly registered.

6. The nations shall endeavor, as much as possible, to establish international aerial circulation and make national laws as much as possible in harmony with the international laws.

7. The nations shall endeavor, when there is aerial warfare, not to harm or interfere with neutral countries, and shall try to humanize aerial warfare as much as possible.

8. The inviolability of private aerial property is to be observed.

9. The nations at war will endeavor not to restrict the commerce of neutral nations with the restriction of war contraband.

10. The inviolability of neutral nations is to be observed.

11. A conference to formulate notes for the employment of airplanes in the service of the Red Cross in order to succor the wounded should be held.

12. In order to facilitate the development of aerial locomotion and to be in accord with one another, in order to make legislation governing aerial locomotion uniform, a congress will be called which will make a code which will govern universally the activities of aerial locomotion.

13. The first conference of the Aeronautic Pan-American Federation represented therein and the countries which may desire to be followers of the same to come to an international agreement which will give an outline of facilities for free transit, entrance and departure of all kinds of airplanes, etc., thru the aerial territory of each country.

We in this country are mostly concerned with Federal or interstate laws. Very little has been done along these lines here. The crop of laws up to 1912 in the legislatures of the various states and some of the projects proposed have been amateurish in the extreme, and well deserved the fate that overcame them. In the House of Representatives, Representative Warner proposed to have a law passed to prohibit aviators from ascending to a height of more than 1000 feet. To bind the aviators to obey the law, he included clauses requiring aviators to give a bond of $10,000. Surely a fall of 1000 feet is as likely to be fatal as a 5000 foot fall. Altho in the latter the aviator has a chance of regaining control before reaching the ground, in the first he had not. Likewise, the aviator would be deprived of the means to escape storms and unsettled atmospheric conditions by flying to higher and quieter atmospherical strata if caught by a storm. The Aero Club of America has advocated Federal registration of pilots and aircrafts for some time. "What is needed is a system of Federal licensing which will enable aviators to fly across the continent with the least inconvenience. A transcontinental airplane contest is now being planned. In a few years such flights across the continent will be common and will be made in between twenty-five and forty hours. If state registration were necessary, it would take longer to register than to cross the continent.

"Registration of aircraft is recommended as an important measure. There have been reports of late of strange airplanes which have been flying near large munition plants. Had we a system of registration, all aircraft would be under Federal control." Laws can kill or foster a sport or an industry.

—Manufacture of Airplanes

See also

Steel—Use of in aeronautics

[Fourteen Years of the Airplane. *Scientific American*, Feb 24, '17. 600 words.]

The early airplanes were built; the airplanes of today are manufactured. Therein is represented the history of aviation to date since Dec 17, 1903, when Wilbur and Orville Wright made their initial flights over the sand dunes of Kitty Hawk, N. C. The early machines were constructed in a haphazard manner because the builders did not realize the stresses to which their craft would be subjected in actual flight. As a result, a hundred or more men lost their lives. To-day machines are manufactured according to designs in which stresses and strains under the most adverse flying conditions have been computed and multiplied by a factor of safety of six or more. Also, the materials are selected for their strength. Consequently, flying has been made comparatively safe, perhaps no more dangerous than work with structural iron.

[Aircraft Industry Needs Standardization. By Howard E. Coffin of the Council of National Defense. *Aviation*, May 1, '17. 1148 words.]

The rapid growth of the American motor car industry has been looked upon as one of the wonders of the world's progress, but the developments in machines for the navigation of the air bid fair to eclipse even the spectacular rise of the horseless road vehicle. No other means of transportation has come upon us with the suddenness of the flying machine. The European war has set the clock of this art ten years in advance. The end of this development cannot even be guessed. Millions of dollars have been voted for aircraft by Congress, and the industry thus suddenly born has become a vital necessity in our plan for any future defense of this nation. The individual engineer or builder is no longer an irresponsible free lance, but has become merely a cog in the great industrial machine in which the American nation is vitally interested. As a result of our rapid expansion of aeronautics, chaotic conditions are sure to ensue. The engineer is the originating end in any industry, and if his work is faulty or lacking in its adherence to accepted standards of excellence the efforts of all the other departments of the plant cannot make good his error. Standard materials may be stocked in quantity at their source and shipped immediately upon

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receipt of order. A certain manufacturer of screw machine parts is operating a large plant almost exclusively on airplane fittings for many different concerns. In one particular bolt used for the same purpose by these airplane builders he is asked to turn out of his plant simultaneously six different specifications as to metal, each requiring a special heat treatment, fifty different lengths, eight variations of a few thousandths of an inch each in diameter, and six different thicknesses of bolt heads, amounting in all to several thousand variables intended to serve almost exactly the same purpose. When the further statement is made that this same maker is supplying more than three thousand parts for one well-known model of airplane, these parts divided into 240 separate items, one may begin in some manner to appreciate some of the reasons for slowness in delivery on Government contracts for aircraft for the defensive service of the nation. The aircraft art is young, and large investments in dies, jigs, special tools and production tools and fittings have not yet been made. No time must be lost in beginning this work on standards, upon which must be based the whole future development of the industry. The production of aircraft in America to-day is limited by the ability of parts makers to make delivery on non-standard materials. Shall we profit by the lessons of the motor car industry and cure this ailment while the art is yet young?

[Materials in Airplane Construction. By N. L. Liebermann. *Aviation,* June 15, '17. 2502 words.]

A proper determination of the desirable physical properties of linen must be based on an analysis of the linen under load.

The use of linen as a structural material is comparatively new. On this account there exists a great variation in the requirements which this material must satisfy. A table and curve give the estimated pressure at 150 m.p.h., on an R.A.F. No. 6 wing curve, at 15 deg. angle of incidence.

The general type of panel used in current practice is designed with a rigid covering on the upper surface, from the leading edge to the front beam. This is generally a wooden veneer. The area covered by the linen commences at the rear edge of the upper flange of the front beam. The bottom surface is generally completely covered with linen.

The tension in the linen is dependent upon several factors, among which may be mentioned, (1) the span or distance between center line of ribs, (2) the loading, and (3) the initial tension in the linen, due to the application and shrinking of the dope.

Under the conditions above assumed (velocity 150 m.p.h. and the machine straightening out from a nose dive), the upward lift on the front edge would have a maximum value of approximately 298 lbs. per sq. ft., or 2.07 lbs. per sq. in. If linen were used as the covering, and the distance between the inner edges of the ribs be taken as 15 in., the loading on the linen per inch width in the direction of the chord would be $15 \times 2.07 = w - 31.05$ lbs.

The tension in the linen is 35.2 lb. per linen inch width. While this would allow a factor of safety of 2.72, the longitudinal contour of the panel would be extremely distorted by the "rise" in the span of the linen.

The entire foregoing discussion clearly shows that the linen requirements demanded by present practice are very high. Only under rare occasions does the tension rise over 25 lb. per inch width. A factor of safety of 5, with the average loading 15 lb. per inch width, would require a linen of 75 lb. per inch width ultimate strength.

There is no doubt that the ideal dope should be a cellulose ester. The particular choice between a nitrate or an acetate, or a combination of the two, or even some other formula, is a matter which has not yet been fully determined by laboratory research.

Tetrachlorethane has the decidedly advantageous property of rendering a dried cellulose acetate solution very pliable and elastic; but the normal disadvantage in the use of this compound is the poisonous fumes given off in the handling.

The disadvantages of the nitrates are:

(1) The rapid evaporation of the solvent, alternately leaving little or no cellulose coating on the fabric.

(2) The inflammability of the coating, either wet, dry, or in fumes.

(3) Its unstable equilibrium in sunlight.

There is undoubtedly a certain definite relation between the rays of the sun and the decomposition of cellulose nitrate dope, for this compound, when subjected to artificial heat of even greater range of temperature than that derivable from sunlight, does not show as great a diminution in volume, nor the breaking down of the radicals.

A film made of either an acetyl or a nitro-cellulose compound, subjected to spectroscopic analysis, should individually give their distinctive spectra. If these be examined for different periods of time of exposure to the sun's rays, it may be expected that certain lines will be accentuated, due to some internal rearrangement of the radicals. The co-relation between these lines and the decomposition of the dope would then offer a clue to further lines of study.

Streaks are the results of unequal evaporation in the body of the deposit. This is most probably due to the method of application with brushes.

A determination of any one physical constant for dopes does not necessarily give a clue as to its desirability.

In conjunction with the above constants, the dope should show distinct adhering and penetrating qualities when applied to fabrics; comparative solubility of "dried" dope in liquid dope; and reasonable resistance, when dry, to the action of the elements.

—Manufacture of Airplanes—Propellers

[The Construction of Airplane Propellers. By Frank W. Caldwell. *Aviation,* May 1, '17. 2400 words. Illustrated.]

There are a large number of woods used in the construction of airplane propellers. The woods most

commonly used in American practice are birch, Honduras mahogany and white oak. Other woods that are sometimes employed are: maple, spruce, poplar, ash, and gum. For engines up to about 50 hp. spruce is a most satisfactory wood, as it is light, strong, easy to glue, and is not excessively affected by changes in climatic conditions. For engines of from 60 to 100 hp. alternate laminations of maple and spruce have been used in a great many cases. The arrangement is always made so that the maple boards come on the outside in order that the harder wood may come in contact with the metal hub plate and prevent the plates from sinking into the wood. Honduras mahogany has been used for these engines and has given very good results as it is very easy to glue, is comparatively light, and is very little affected by climatic changes. It is easily marred, however, and is only moderately strong. Quarter-sawed white oak has given about the best results for from 60 to 100 hp. engines. It has a very high tensile strength, and a high compressive strength across the grain and is not very much affected by climatic changes. For the very large engines of about 200 hp. it is rather hard to say which wood has given the best results. In order to keep down the weight the hub flanges are usually made as small as possible and this makes it necessary to have a very high bearing pressure on the hub plates so that the friction between them and the wood may be great enough to drive the propeller. This makes it necessary to use wood with a high compressive strength across the grain in order to prevent the hub plates from sinking into the wood. Birch shows more resistance to this than any other wood with the possible exception of maple. Quartered white oak is a very good material for use with big engines. It is to be preferred to birch in most cases. On the Mexican border it was found possible to get poplar that was well seasoned in that climate and this wood had to be given preference for this reason. Most wood becomes brittle or "brackish" in the climate of the Mexican border. Black walnut has not been used to any extent in the United States, but is used a great deal in England. The fault found with it in this country is that it is heavier than Honduras mahogany and has a lower tensile strength. The seasoning of the wood is, perhaps, the most important consideration in the construction of propellers. For the best results the wood should be air seasoned for five years before it is used. Under present conditions one is fortunate to be able to get good material that is over two years old. Even after the wood is thoroly seasoned it is best to put it thru a dry kiln before glueing it up. The material may now be dressed down to the thickness of the laminations. This must be done very carefully. The following thicknesses are recommended for laminations: 11-16, ¾, 13-16-inch. In selecting the pieces of wood the pattern is laid on the board so that the grain of the wood runs along the edge of the pattern. All the material falling inside the mark must be absolutely free from knots, season checks, dry rot or other imperfections. The method of glueing the boards together in the form of a block is recommended where experienced workmen are not available. The total pressure applied on a block ten feet long by twelve inches wide will vary from about 2000 pounds for soft woods such as spruce to about 4000 pounds for hard wood such as birch. The choice of the glue to be used will depend upon its reliability in practice more than anything else. An important requirement is that the glue shall not chill for some time after it is applied. The glue should be soaked in cold water for from 18 to 24 hours and heated up gradually during three or four hours to about 160 deg. F. (Some grades of glue require a lower temperature.) The glue room should be kept at a temperature of about 100 deg. F. Failures encountered in glueing should not always be attributed to the glue or to the glueing practice. No amount of care will produce a good glue joint in wood that is not properly dried, and by far the greater percentages of the failures encountered where the work is carefully done can be traced to this source.

—Maps and Mapping

See

MAPS AND MAPPING—AERONAUTIC

—Matériel

[Modern Aerial Armies. By José Carno. *Memorial de Caballería*, Feb, '17. 1600 words.]

After a study of the aircraft strength of the various states, Lafont arrived at the following conclusions:

1. France has first place in aviation and third in aerostation.

2. Germany has first place in aerostation and third in aviation.

3. The aviation service of Austria-Hungary should occupy second place, but aerostation hardly exists there.

4. Italy occupies second place in aerostation and sixth place in aviation.

5. Russia may be given fourth place in both services.

6. England may be given seventh place in aviation and fifth place in aerostation.

7. The United States does not seem to possess the fifth arm of combat.

8. The (before-the-war) classification is about as follows: Belgium, Sweden, Rumania, Greece, Spain, Argentine Republic, Bulgaria, China, Mexico, and Turkey.

[Aeroplanes; Reconnoitering, Observing, Bombarding and Fighting Planes. By Victoriano Casajus. *Memorial de Infantería*, June, '17. 1400 words.]

[The author describes each class of machine, its special features and its tactical use.]

Germany

[Germany's Latest Aeroplanes. *Aerial Age Weekly*, Aug 13, '17. 2300 words. Illustrated.]

Single Seater Chasers

(1) The Albatros D.III. has the tips of the upper plane raked to a much greater extent than was the case with the older models. The bottom plane has been reduced in area, mainly by decreasing the chord; the upper plane is still without dihedral angle. Instead

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of the small radiators mounted on the sides of the body, the radiator is mounted in the center section of the top plane, and the small water tank formerly mounted above the engine has therefore disappeared.

(2) Torpedo, D. This machine is very similar to the Albatros chasers, but has its top plane resting on the top of the body, and its rudder projecting below the tail plane as well as above it.

(3) The Roland Chaser, D.II, is of the true monocoque type. The main planes, of which the upper measures 29 ft. 6 in., and the lower 28 ft. span, have no dihedral, but are swept back as was once the custom in a large number of German airplanes. Ailerons are fitted to the top plane only. The stabilizing plane and the vertical fin are covered with three-ply wood, and both rudder and elevator are partly balanced by triangular projections. The engine fitted is a 175 h.p. Mercédès, with the exhaust pipes bent outward and backward as on the Albatros. The weight of the machine empty is 1450 lbs.

(4) The Halberstadt Chaser. The wings are staggered and have a dihedral angle, but are not swept back. Ailerons are fitted to the top plane only, and are warped. The engine is a 120 h.p. Argus six cylinder water cooled. It has overhead valves, which are not, however, operated by an overhead camshaft as in the Mercédès, but by tappet rods and rockers, as in the Benz.

(5) The Rex Chaser is similar to the Nieuport. The body is of the monocoque type three-ply wood, with projections for the attachment of the lower planes.

(6) The Fokker Chaser Biplane. Two types of this machine have been turned out, one with a 100 h.p. rotary engine (Oberursel) and the other with a 175 h.p. Mercédès. There is neither dihedral angle nor sweepback, but a fairly large stagger. A low cabane of the Nieuport type connects the upper plane and the body. Lateral balance is maintained, not by means of ailerons, as in practically all modern biplanes, but by the now obsolete method of warping the wings.

Two-Seaters, 175 H.P.

(1) The Roland Two-Seater. Both wings are perfectly straight, the top one resting on the roof of the body. The planes are heavily staggered, so much so that the rear spar of the top plane is vertically above the front spar of the bottom plane. Ailerons are fitted to the upper wing only and are peculiar in that they are hinged along a false spar, forming an angle with the two main spars. The engine is a 175 h.p. Mercédès, and the armament consists of two machine guns and under the body four bombs placed longtitudinally.

(2) The A.E.G. (Type C. IV.) The wings are set at a small dihedral and also are set to slope back slightly. There are two sets of struts on each side, and the machine is remarkable for its exceptionally large gap between the planes. The wings are built entirely of steel tubes, with the exception of the leading edge and the intermediate ribs. The engine, a 175 h.p. Mercédès, is mounted on two longitudinal bearers of square cross section steel tube. The petrol tank and radiators are incorporated with the center section of the top plane. The armament consists of two machine guns, the front one fixed and synchronized and the rear one on a gun ring. It has place for four bombs placed one on top of another on the right side of the passenger.

Two-Seaters, 225-240 H.P.

(1) The L.V.G. Type C.IV. differs very little from the L.V.G. already dealt with. It has an eight cylinder vertical Mercédès motor. The armament consists of two machine guns and of four bombs.

(2) The D.F.W. Aviatik. One of the characteristics of this type is that the backward slope of the wings has disappeared. The dihedral has been retained. The body, which is of rectangular cross section, is covered with three-ply wood and is very pointed toward the nose, where it terminates in a spinner covering the propeller boss. The engine is a six cylinder Benz, developing 228 h.p. at 1410 r.p.m. The standard complement of two machine guns is carried and the bomb chamber will hold six bombs. The weight of the machine empty is 2100 lbs.

(3) Albatros B.F.W. 225 h.p. (type C.V). The ailerons are balanced by a portion projecting forward in an opening in the wing. The engine is a six cylinder vertical developing 225 h.p. (1415 r.p.m.). There are two machine guns and two bomb carriers.

(4) Two-Seater 260 h.p. Rumpler. This machine follows along the lines of the old model. It has a 260 h.p. Mercédès motor and the shape of the tail planes has been altered somewhat.

Twin Motor Machines

(1) The Twin Engine Gotha Three-Seater 520 h.p. This machine will probably be the most important of those included in this series. Altho by far the largest of all the German machines, the Gotha is not quite so large as the Handley-Page biplane. The Gotha has its propellers at the rear of the wings and has a considerable back slope to the main planes. Its tail is of the monoplane type. The top plane is built up in two halves, attached to a central cabane, while the bottom plane is in three sections, one of which runs from the inner side of one engine housing to the inner side of the other engine housing. The enclosed body is of rectangular cross section. Behind the pilot are two bomb racks, while still farther back is the cock pit for the second gunner. Two guns are within reach from this seat, one is placed above the body while the other fires down thru a tunnel sloping backward from the cock pit. The engines are placed in roomy nacelles resting on the bottom planes. They are six cylinder vertical motors developing 260 h.p. The radiators are mounted in the nose of the engine housing and under them are placed the oil tanks. The armament consists of three machine guns which have

a field of fire in all directions from the machine due to the manner in which they are placed.

(2) Twin Engine A.E.G. 450 h.p. This machine which is built entirely of steel, is fitted with two Benz or Mercédès engines of 225 h.p. each, placed in nacelles between the wings. The radiators are in the nose of the nacelles as are also, in contradistinction to the Gotha, the air screws.

[New German Machines on the Western Air Line. *Sphere,* Apr 21, '17. Drawing and description. 200 words.]

The Germans are using two new designs of airplanes on the western front. One is a single seat biplane from the Fokker works. It has warp control and raised center section in the upper plane to clear the machine guns. The speed is about 120 miles per hour and the climbing power is great. The armament is two fixed machine guns, operated by a single trigger and synchronized to fire thru the propeller. When both guns are in use a deadly spray of bullets is delivered. The new Fokkers attack from behind or below.

The other design is a single seater Albatros, closely resembling the French Spad. The span of the planes is only 27 feet, engine 120-h.p., water cooled. Two fixed machine guns fire thru the propeller.

[German Military Airplanes. *Scientific American,* July 14, '17. 2500 words.]

In this war no detail of enemy airplane construction can remain a secret long, because captures and bringing down of machines occur frequently. Altho all pilots are ordered to destroy their machines and prevent them falling into enemy hands, this cannot always be done.

The present war has served to develop new types of machines, and they are now classified in five more or less distinct groups—reconnaissance, artillery spotters, bomb-droppers, battle-planes, and a hybrid type used as escort to bomb-droppers, to drive off hostile chasers, and even occasionally to attack infantry.

The Germans had a large number of *Taubes* at the beginning of the war, and some are still in use, altho fewer than formerly. They are unsuitable for work requiring great speed. The latest types have been considerably improved. The German biplanes were in a high state of development before the war, and have been improved little beyond the use of more powerful engines.

The most sensational surprise sprung by the Germans in the air was the introduction of the Fokker, a little monoplane of only 36-foot span [some details of construction given], which played great havoc with the Allied machines. The tactics of the Fokker were to dive from a great altitude or come up from behind, and it was thru the use of the Fokker that the Germans were able to chronicle the destruction of the fifteenth, etc., enemy airplane by certain pilots. It is, however, a difficult machine to fly and to learn on, and is said not to possess a good fore and aft control. The Allied answer to the Fokker was the Nieuport single seater.

The German constructors and designers have been able to keep pace with French and British aircraft. The Allies have introduced fast machines, capable of climbing 10,000 feet in 10 minutes, and Germany's answer is yet to be seen. The French have also introduced the Spad biplane, capable of a speed of 130 miles per hour, and the British have not been slow in developing new machines to combat the German types.

The German efforts have been along the line of refining and improving existing types and furnishing more powerful engines. This has even reached the point of encroaching upon the necessary factor of safety, as some German machines have been seen to break in the air. This indicates overstrain by excessively powerful engines, which is a poor solution of the problem of more speed and climbing power.

[The Gotha's Gun-Tunnel and Gangway. *Sphere,* Aug 4, '17. Drawings and 200 word description.]

The Gotha bombing airplane employed in the recent raids on London, has a span of 78 feet. It embodies two important features—a gun-tunnel and a connecting gangway. There are two cockpits, one forward and one aft of the pilot's seat. The two cockpits allow the usual fire, and there is a gangway passing to one side of the pilot's seat that allows movement between the two cockpits, so that the forward gunner can join the rear one if necessary. There is a gun-tunnel leading downward and to the rear, this covering what was previously a blind spot. This feature, together with the gangway, enables both gunners to fire to the rear in case of pursuit.

United States

[Aviation Notes. *Army & Navy Jour.,* Feb 3, '17. 100 words.]

A "baby speed-scout" capable of flying 120 miles an hour, and two reconnaissance airplanes, arrived at the Army Aviation School, San Diego, Cal., on Jan 31. The "baby scout" has a wing spread of 25 feet and can climb 10,000 feet in 10 minutes. In February, two pursuit triplanes with speed of 125 miles per hour, are expected. These triplanes are said to compare favorably with the best machines used in Europe.

[Note. *Army & Navy Jour.,* Feb 3, '17. 275 words.]

In "Some Problems in Airplane Construction," a paper prepared jointly by Capt. V. E. Clark and Capt. T. F. Dodd, Signal Corps., U. S. A., and O. E. Strahlman, a War Department engineer, the requirements of military airplanes are outlined. A strategical reconnaissance machine should have fuel capacity for a flight of at least 500 miles without a stop, its average speed should be not less than eighty miles an hour, and it should carry one pilot, one observer, sketching outfit, camera, wireless set and navigating instruments. An airplane for long range bomb throwing should have fuei capacity for a 400-mile flight, starting with a load of bombs weighing 400 pounds. The machine should

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be capable of defending itself from hostile aircraft. Such a machine fully loaded would weigh about 5000 pounds. The pursuit machine, needed to drive off hostile airplanes, and carrying only a pilot, should have a speed of 130 miles per hour. It needs rapid climbing ability, high speed, and the greatest possible dodging ability.

[Winning the War in the Air. By Henry Woodhouse. *National Service*, Aug, '17. 3000 words. Illustrated.]

Congress has appropriated $640,000,000 for army aeronautics and strategists are coming to believe that the war will be decided in the air. Every day costs 5000 lives and $500,000,000 to the Allies, so haste is essential.

The aerial deadlock may be broken by bombing operations against military and naval nerve centers, or by fighting operations having in view complete control of the air. The bombing operations could be carried out at night, and the problem of building the requisite number of bombing planes could be solved. Neither side has been able as yet to accumulate the necessary number of fighting airplanes to secure aerial supremacy by major aerial operations.

Types of airplanes for carrying large quantities of explosives are now available. The Curtiss triplane, the twin-motored Handley-Page biplane, and the new three-motored Gallaudet seaplane are among the possibilities for long distance raiding. Italy leads, however, in this type of machine, with the giant Caproni. Various classes of this machine are the 1800 h.p. triplane, carrying probably five tons of explosives and fuel for twelve hours, with a speed of about 80 m. p.h. (Exact details of this machine unknown); the 600 h.p. bombing triplane, with three independent engines, which carries six hours' fuel, a crew of three, three guns, and 2750 lbs. of bombs, with a speed of 80 m.p.h., and a climbing power of 10,000 feet in 57 minutes; the 600 h.p. bombing biplane, of much the same characteristics except a speed of 92 m.p.h., a climbing power of 13,000 feet in 40 minutes, and carrying 1150 lbs. of bombs; and a triple motor 450 h.p. bombing biplane, speed 85 m.p.h., climbing power 13,000 feet in 30 minutes, crew of three and three guns, and carrying 450 lbs. of bombs. This last type has been in successful use for the past two years. The French, British and Russians have also 250 to 600 h.p. machines extensively used for short distance bombing raids, and easily adaptable for longer distance work.

The five fundamental factors in maintaining aerial supremacy are:

(1). Speed and climbing ability.
(2). Position of the airplane.
(3). Skill in piloting and using guns.
(4). Number of machines.
(5). Destructiveness of projectiles.

Speed and skill are the most important factors and together enable the advantage of position to be gained. Numbers make up for lack of speed and skill. The destructiveness of the projectile is a most important factor. The machine gun bullet must strike a vital part of the machine or pilot to be effective, whereas, a shell would disable a machine by striking it almost anywhere.

Major aerial operations should prove decisive. A fleet of a thousand heavy bombing machines could cover the distance (225 miles) to important enemy centers in 3 or 4 hours and could then deal an effective blow.

—Motors

See also

LIBERTY MOTOR

[The Twelve Cylinder Curtiss 250 H. P. Motor. *Aerial Age Weekly*, Oct 16, '16. 1000 words. Illus.]

The Curtiss Aeroplane Company has recently built a twelve cylinder 5 inch by 7 inch motor which weighs 3½ lbs. per h.p. and develops 300 h.p. at 1400 r. p. m. Its length over all is 80 inches, and it has a counterbalanced crank shaft with bearings between each crank and individual forced lubrication. It is equipped with two Dixie magnetos and two Duplex Zenith carburetors. By having a compression release, the cranking of the motor is made very easy. The motor weighs 1125 lbs., radiator 120 lbs., water 100 lbs. and propeller 95 lbs. The gasoline consumption is 6-10 lbs. per h.p. hr., the oil consumption 2 pts. per hr.

[Note. *Army & Navy Jour.*, Dec 2, '16. 200 words.]

Formal test has been made of a Knox 300 h.p. areonautical motor. This is said to be the first aeronautical motor of this power ever built. The motor complete weighs 1400 lbs. It was run for 8 hours and showed its rated power during the last hour. Nickel and vanadium steel and special aluminum alloys were used in the construction. There is great need of a motor of this type.

[Allies Ordering 6275 Hispano-Suiza Engines, *Aviation*, Dec 15, '16. 500 words.]

The Hispano-Suiza Works of Paris and Barcelona are building 2000 150 h.p. aero engines for use with the French and Spanish aviation services and additional orders aggregating 4275 engines of the same model have been awarded the following concessionaires: 2375 from the factory in France, 200 with the factory in Great Britain, 200 engines with the factory in Italy, 500 with the factory in Russia, 1000 with the factory in the United States. The Hispano-Suiza Works are also about to place on the market an eight-cylinder V type aircraft engine developing 200 h. p., which will be practically identical with their 150 h. p. model but for a geared-down drive. The Hispano-Suiza motors are used on machines with good results as follows: Blériot high speed monoplane traveling horizontally at rate of 200 kilometers per hour. This machine can climb 3000 meters in ten minutes and 30 seconds. The Caudron two-seater biplane carries load of 625 kg. at speed of 142 km. per hour and can climb 3000 meters in 28 minutes and 40 seconds. The area of the Caudron is 64 sq. meters and the Blériot 18 sq. meters.

[The Trend of Design in Foreign Aeronautic En-

gines. By F. H. Trego. *Aviation,* Feb 1, '17. 1350 words, with charts.]

(A technical discussion in which thirteen foreign motors are compared but no names are given. The article shows the horsepower per cubic inch of displacement, the bore stroke ratio, the horsepower per piston displacement, weight per h.p. ratio, the gallons per h.p. hours consumed and other features of the engines now in use abroad.)

[Mufflers for Aeronautic Engines. By Prof. H. Diedrichs and Prof. G. B. Upton, of Cornell University. *Aerial Age Weekly,* Apr 23, '17. 1751 words. Illustrated.]

The necessity for muffling the exhaust of airplane engines is hardly open to argument. The objects in view are the minimizing of noise to delay detection in military service, to protect the general public, particularly those living near aviation fields, and lastly to give the operator a better chance to know what the rest of his power plant is doing.

The exhaust noise is not the only disturbance to be dealt with, altho perhaps the most important, because the staccato barks of open exhaust carry to greater distances than the other attendant noises.

Assuming that a successful device for completely muffling the exhaust can be found, we should still have to deal with other noises, such as the hum of the propeller, the singing of gears, and the rattle of the valve gear. It will be admitted that all of these sources of noise can be minimized, but elimination does not seem to be in the realm of possibility.

These four sources of noise are the principal ones requiring attention. We would place them in order of importance: (a) Exhaust noise; (b) propeller noise; (c) valve-gear noise; (d) gear noise. We believe that it is most important to suppress the exhaust noise, because its staccato barks will undoubtedly advertise the rising of a plane sooner than the other three by reason of its greater carrying power.

Confining our attention now to the particular problem in hand, the silencing of the exhaust, a successful device will have to meet three requirements: (a) Satisfactory suppression of noise with least back pressure; (b) lightest possible weight; (c) greatest durability.

The state of perfection at present reached in the muffling of auto-engines is well known. Some tests were carried on at the University of Michigan. Five types of mufflers were tested and investigated as to back pressure, horsepower loss, and muffling ability. The one given the highest rank on all three counts weighed 14.5 pounds, which is equivalent to 0.36 pound per horsepower. This muffler showed a back pressure of only slightly over 1 pound at the maximum speed, the loss of horsepower being 1.4 per cent. at the maximum.

The principle underlying the action of muffling is simple. At the moment of opening of the exhaust valve the pressure conditions are such that the gases issue at velocities of approximately 2000 feet per second. The problem is to reduce this velocity below that of sound (1100 feet per second) without causing undue back pressure. The means at hand to accomplish this are: (a) Cooling of the gases to reduce volume, (b) gradual expansion, (c) internal friction and eddy currents in the gas, and (d) frictional resistance between gases and containers and baffles.

As far as application to the engine is concerned, three solutions are possible. The first is to use individual mufflers for each cylinder.

The second scheme is to combine manifold and muffler, *i. e.,* to internally construct the manifold to convert it into a complete muffler.

The third scheme is to use a regular manifold and to connect this by means of flexible hose to the muffler proper. We believe on all counts that this combination is the best solution.

Two manifolds of light-weight steel were cross connected by another manifold, so that we finally had a single discharge and only one experimental muffler had to be built.

This muffler was connected to the outlet of the cross manifold by a short piece of flexible metallic hose and in parallel with a quick-closing gate valve. An electric tachometer, carefuly calibrated, was used to note changes in speed, and the back pressures were observed by means of mercury manometers connected to the side manifolds near their connection to the cross manifold.

Trials with this muffler showed the following:

(a) The application of the side manifold and of the cross manifold alone served to tone down the barks considerably.

(b) The application of the muffler raised the back pressure only about 0.1 inch Hg., which is a very good result. The power loss is negligible.

(c) As far as muffling is concerned, three observers judged that the exhaust noise was cut out to the extent of about 50 per cent.

In the University of Michigan tests, above quoted, besides using independent observers, a telephone was used, the observer in a room some distance away noting the distance between himself and the telephone at which he failed to distinguish the exhaust noise.

[The Mechanical Development of Aviation. By Neil MacCoull, M.E. *Aerial Age Weekly,* May 7, '17. 3160 words. Illustrated.]

Aviation is one of the most fascinating branches of mechanical engineering. It seems as if it were born in mankind of all ages to long for the mastery of the air; the mythology of all peoples is filled with evidences of it.

It is a matter of historical record that actual experiments were made with artificial wings as far back as the early part of the seventeenth century.

The earliest systematic experiments with mechanical power were started in 1889 by Sir Hiram Maxim. From the data obtained he constructed a very large twin propeller airplane in 1893, with steam as the motive power. The span of the wings was 104 feet, which to this day is exceeded only by a very few machines. It was intended to fly at a speed of only 35 to 45 miles an hour. In the experiments with this

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machine, the running gear was provided with flanged wheels which ran on a straight level track of 9 foot gauge. This airplane not only lifted its own weight of 8000 pounds, but also broke the stout plank guide rails which held it to the earth, and caused a wreck. But in spite of being able to support itself it could not be called a successful airplane, because its stability and airworthiness were never demonstrated in free flight.

Each of the two propellers, which were 17 feet 10 inches in diameter, was directly connected to a double acting compound engine, with cylinders 5 and 8 inches bore, and a stroke of one foot, high pressure cut-off being at 3/4 stroke, and low pressure at 5/8. With a steam pressure of 320 pounds per square inch, each developed 180 horsepower at 375 r.p.m., a weight of only 1 3/4 pounds per horsepower.

The weight of the engines and boiler totaled 1640 pounds, or about 4 1/3 pounds per horsepower.

At almost the same time that Sir Hiram started his experiments, Samuel Pierpont Langley the real "father of aviation," was learning the fundamentals of aerodynamics by means of models with rubber motors.

Out of all the experimental development of nine years of strenuous work, there was evolved a steam driven model known as No. 5, which had a wing spread of 13 feet, and which weighed 26 pounds complete. On the afternoon of May 6, 1896, this model was launched over the Potomac River with a steam pressure of 150 pounds, and started directly ahead into the gentle breeze which was then blowing. After launching it slowly descended three or four feet, but immediately began to rise, and at the same time circled to the right and moved around with great steadiness, traversing more than two complete spirals. After the lapse of one minute and twenty seconds, when at a height of from 70 to 100 feet, the fuel was exhausted and the airplane gradually descended until it finally touched the water after a flight of one minute and thirty seconds. in which a distance of over 3000 feet had been covered.

Langley's large man-carrying airplane, which was tried out in 1903, was launched from a similar device, and failed to make successful flights on account of some accident which tripped the machine just as it was leaving the car and threw it into the water.

This happened twice, and caused so much ridicule in the press that Mr. Langley was unable to get any further financial aid. A few years ago Glenn Curtiss repaired this airplane and by fitting it with pontoons so that it could rise from the water, was able to make a very pretty flight, proving it to have been the first absolutely successful man-carrying airplane ever built.

It will be recalled that the Wright brothers used a launching device operated by falling weights in all their early experiments, and a similar catapult is now used for launching airplanes from battleships in our navy.

Two Americans succeeded in producing the first man-carrying airplane which could support its own weight in stable flight; Samuel Langley produced the airplane, and Charles Manly produced the power plant.

[The Mechanical Development of Aviation. By Neil MacCoull, M.E. *Aerial Age Weekly*, May 21, '17. 2032 words. Illustrated.]

All this work of Langley's was terminated in 1903. Four years later Blériot constructed an airplane of the Langley type, and was able to make short flights of a few hundred yards. In looking over some of my clippings a few days ago I found one from the New York *Herald* dated Sept. 9, 1908, with large double column headlines which read: "Orville Wright Flies for 11 Minutes." It brought home very vividly the extreme youth of this new science.

Five years elapsed from the time Langley solved the aerodynamic and mechanical details necessary for flight, before the Wright brothers succeeded in flying before the public for eleven minutes; and in 1914, only six years later, the world's record for a non-stop flight had been raised to 24 hours, and a distance of 1500 miles. This record still stands officially, for what is done in warfare is not accurately known by the public.

An engineer with whom I am acquainted has just returned from Europe with the most amazing accounts of the magnitude of foreign aeronautical progress. He states that there are in France to-day 70,000 men wearing the uniform of the British Flying Corps, including pilots, mechanics and other helpers. France and England together have about 14,000 licensed aviators, and Germany and Austria undoubtedly have as many. These 28,000 aviators do not include those of Russia and Italy.

One of the first engines to spring into prominence while airplane progress was being made by leaps and bounds, was the Gnome. It was an air-cooled revolving type somewhat resembling Mr. Langley's early tho unsuccessful engine, and is an example of the most beautiful workmanship of which French mechanics are capable.

The Le Rhone is another engine of similar type, tho considerably improved, and is now manufactured by the Gnome Company.

The only radial water-cooled engine which has enjoyed any degree of success since Mr. Manly's development of this type, is the Salmson, and during the first part of the war it was highly spoken of in France.

But the great majority of modern airplane engines are an outgrowth of conventional automobile practice. One of the most famous engines of this type is the German Mercédès, which has had such phenomenal success that many of the latest engines follow it in general design. In fact, this very engine was used in racing automobiles, and has given their drivers many enviable records. No very great effort has been taken to make this engine especially light except in the cylinder construction. The cylinders, which are in pairs, are built up from steel by welding the individual parts together.

There are a few characteristics of this engine which it is well to point out here, since they are now found on practically all airplane engines. One is a double carbureter for six cylinders. Surprising claims of gains

in engine power are made for the use of two carbureters instead of one. Instances of over 20 per cent gain are claimed. This seems hardy possible except that practically every successful six cylinder airplane engine on the market makes use of two carburetors. Another feature is the use of a double ignition system; two independent magnetos and two sets of independent spark plugs to each cylinder.

From the remarkable performance of these engines before the war, it is natural that we should be very inquisitive about the developments which have taken place under the stress of war service.

[The Mechanical Development of Aviation. By Neil MacCoull, M.E. *Aerial Age Weekly,* May 28, '17. 1616 words. Illustrated.]

No official confirmation has been received so far of any Mercédès engine with more than six cylinders except the one shown, which was built for Zeppelins; but the modern Zeppelins do not use this type of engine. Instead they use six cylinder vertical engines of 100 h. p. at 1200 r.p.m., the cylinders being about 6 inches in diameter with a 7½ inch stroke. The most interesting feature of these engines is the use of five valves in each cylinder head; two intake and three exhaust.

One of the first American engines to follow the lead of the Mercédès as to type was the Hall-Scott. The cylinders of this engine, while individual as in the latest Mercédès, are cast with integral water jackets, giving a more rugged tho heavier construction.

The two points of chief interest shown in the section of the Mercédès valves, are the method of building the cylinders up by welding, and the location of the rocker fulcrum so as to give the valve 50 per cent greater lift than its cam.

The valve construction of the Wisconsin engine will be described later.

Another six cylinder engine of this general type is the Christofferson. The rocker arms are of different lengths, as in the Mercédès, but the whole valve mechanism, including springs, is enclosed. This makes a very neat arrangement and one that assures excellent lubrication of these parts, but it is doubtful if it is a wise policy to enclose the springs.

The experimental engine built by the Packard Motor Car Co., which is shown in Fig. 16, is worthy of attention because it has been developed under intimate knowledge of requirements at the battle front. It is a twelve cylinder V-type engine with 60° between rows of cylinders. The intake manifolds, of which there are two, are the first departure from usual practice which meets one's eye. They are designed with the idea of supplying each cylinder from a large header in which the gas velocity is so low that every cylinder has almost the same pressure drop from the carburetor which is located in the middle.

One of the well known British engines is the Sunbeam. In this design the manufacturers have finally discarded the L-head cylinders which have characterized all previous Sunbeam airplane engines, and have made a radical departure from usual valve mechanisms. There are four valves to each cylinder, two intake and two exhaust, and these valves are operated by two overhead cam-shafts to each row of cylinders, one shaft for the inlet valves and the other for the exhaust.

The new water-cooled Renault of 220 horsepower. For years the manufacturers of this engine have supported the twelve cylinder V-type engine with forced draft air cooling. Now they have adopted water. They have also dropped the high speed feature with geared down propeller shaft, and the valve mechanism with cam-shaft in the crankcase—features which have always been characteristic of Renault airplane engines. The valve mechanism is now strikingly like that of the Mercédès.

So far the development of the airplane power plant has been dealt with almost entirely, but engines do not begin to cover all the mechanical parts of modern airplanes. The time is so limited that I can merely mention a few of the other parts which this new science is developing. Mechanical starters alone make quite a study, and besides compressed air distributors and air engines include even small gasoline engines of about 4 horsepower which weigh but 23 pounds with their own magnetos and carburetors. Mechanical stabilizers also have been developed.

[Details of German Aviation Engines. By E. H. Sherbody, Engineering Department, Peerless Motor Car Co. *Aerial Age Weekly,* July 2, '17. 4752 words.]

In October, 1909, Farman succeeded in flying 3 hr. 4 min. with a Gnome motor. It was this year that Glenn Curtiss went to France and astounded the world by carrying off the Gordon Bennett Cup with a Curtiss biplane driven by a Curtiss engine 3¾ in. bore and 3¾ in. stroke. This motor is said to have weighed 200 lbs. and gave 35 h.p. at 1000 r.p.m. It was also in 1909 that Louis Blériot succeeded in flying across the channel in a Blériot monoplane driven by a three-cylinder 25 h.p. Anzani motor. The flight was made in barely ½ hour. and it was immediately after this flight that the British War Office first became interested in the military possibilities of heavier than air machines. Shortly after this Lord Northcliffe organized the Daily Mail Contest Prize, which was $25,000 and was won by Col. Cody for a flight from London to Manchester. From this time on considerable interest in aviation was manifest in all European countries and each of the various governments took it upon itself not only to investigate the military possibilities of aviation but also afforded substantial support to the builders of airplanes and airplane motors. This is particularly true of Germany. where in 1913 there was organized the Kaiser Prize Contest for the best aviation motor that could be developed.

The largest sized successful airplane motor built up to 1909 was the 100 h.p. Antoinette. This year planes have been flown with a total of 1700 h.p.

The 150 h.p. six-cylinder Mercédès motor is 140 mm. bore and 160 mm. stroke. This type of motor won all the important places in the Kaiser prize contest with

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the exception of the first prize, which went to the Benz. The principal features of the design are forged steel cylinders with forged steel elbows for gas passages, pressed steel water jackets, which when welded together from the cylinder assembly, the use of inclined overhead valves operated by means of an overhead camshaft thru rocker arms which multiply the motion of the cam. By the use of steel cylinders, not only is the weight greatly reduced but certain liability to distortion thru unequal sections, leaks and cracks is entirely avoided.

In the Mercédès motor the pistons have a drop-forged steel head which includes the piston pin boss; this head is screwed to a cast iron shirt which has been machined inside to secure uniform wall thickness.

Other features of the design are a very stiff crankcase, both halves of which are bolted together by means of long thru bolts, the crankshaft main bearings are seated in the lower half of the case instead of in the usual caps and no provision is made for taking up the main bearings.

The largest of these motors has recently had its power increased to 176 h.p. at 1450 r.p.m. This general design of motor has been the foundation for a great many other aviation motor designs, some of which have proved very successful but none of which, in the writer's estimation, are equal to the original. Among the motors which follow more or less closely the scheme of design and arrangement are the Hall-Scott, Wisconsin, Renault, Packard. Christofferson and Rolls-Royce.

The V-type twin-six Renault motor is 125 mm. bore and 160 mm. stroke. The first important peculiarity of this design is a small angle between the cylinders which is only 47½ deg., and enables the fuselage to be considerably narrowed in width, thus reducing the head resistance. The cylinders of this motor are almost a duplicate of the Mercédès design of steel cylinder with the exception that the elbows in which the valves are inserted are not so carefully designed and the water jacket is carried around only one side of the exhaust valve stem, whereas in the Mercédès motor the water jacket completely surrounds the exhaust valve stem.

The pistons are of cast iron and are the only very heavily designed pieces in the motor, and it certainly seems as tho these could have been considerably lightened. The piston carries three concentric rings which are pinned at the ring gap and have a deep annular rib between the bosses.

The crankshaft is carried in four babbitt-lined bronze shells, which in turn are secured to ribbed steel bearing caps. The bearing caps are locked in the top of case by means of long U-bolts, such as are sometimes used on automobile spring saddles.

The carburetor only differs from the Mercédès in that it uses a single float chamber instead of two float chambers.

The Rolls-Royce, Hispano-Suiza, Hall-Scott and Christofferson used bevel gears for driving the camshaft. All these designs are more or less an imitation of the original Mercédès.

In the Kaiser prize contest for aviation motors a four cylinder Benz motor of 130 by 180 mm. won first prize, developing 103 b.h.p. at 1290 r.p.m. The fuel consumption was 210 grams per horsepower hour. Total weight of the motor was 153 kilograms.

The Benz cylinder is a simple, straightforward design and a very reliable construction and not particularly difficult to manufacture. The cylinder is cast of iron without a water jacket but including 45 deg. angle elbows to the valve ports. The bottom and the top of the cylinders become water galleries, and by this means separate water pipes with their attendant weight and complication are eliminated. Rubber rings held in aluminum clamps serve to connect the cylinders together. The whole construction turns out very neat and light.

The Benz camshaft has a diameter of 26 mm. and is bored straight thru 18 mm. and there is a spiral gear made integrally with the shaft in about the center of its length for driving the oil pump gear. The cam faces are 10 mm. wide.

The seven-bearing crankshaft is finished all over in a beautiful manner, and the shaft out of the particular motor we have shows no signs of wear whatever.

The pistons are of cast iron and carry three concentric rings ¼ in. wide on their upper end, which are pinned at the joint. The top of the piston forms the frustum of the cone and the pistons are 110 mm. in length.

The oil pump assembly comprises a pair of plunger pumps which draw oil from a separate outside pump, and constructed integrally with it is a gear pump which delivers the oil under about 60 lb. pressure thru a set of copper pipes in the base to the main bearings. The plunger oil pump shows great refinement of detail.

Since 1914 the Sunbeam company has produced engines of six, eight, twelve and eighteen cylinders from 150 to 500 h.p. with both iron and aluminum cylinders. For the last two years all the motors have had overhead camshafts with a separate shaft for operating the intake and exhaust valves. Camshafts are connected thru to the crankshaft by means of a train of spur gears, all of which are mounted on two double-row ball bearings.

The modern Sunbeam engines operate with a mean effective pressure of 135 lb. with a compression ratio of 6 to 1. The lubricating system comprises a dry base and oil pump for drawing the oil from the base, whence it is delivered to the filter and cooling system.

The Curtiss OX motor has eight cylinders, 4 by 5 in., delivers 90 h.p. at 1400 turns, and the weight turns out at 4.17 lb. per horsepower. This motor has cast-iron cylinders with monel metal jackets, overhead inclined valves operated by means of two rocker arms, push and pull rods from the central camshaft located in the crankcase. A slightly larger edition

of this type motor is the OXX, which has cylinders 4¼ by 5, delivers 100 h.p. at 1400 turns and has the same fuel and oil consumption as the OX type motor, namely, 0.6 lb. of fuel per b.h.p. hour and 0.03 lb. of lubricating oil.

One of the first very successful European flying engines which was developed in Europe is the Austro-Daimler, which was built after the designs of Herr Porsche. The first of these motors had four cylinders, 120 by 140 mm., with cast-iron cylinders, overhead valves operated by means of a single rocker arm, controlled by two cams, and the valves were closed by a single leaf spring which oscillates with the rocker arm. The cylinders are cast singly and have either copper or steel jackets applied to them. The four-cylinder design was afterwards expanded into the six-cylinder design, and still later a six-cylinder motor of 130 by 175 mm. was developed. This motor uses an offset crankshaft, as does the Benz motor.

The lubrication also is different from any other aviation motor, since individual high pressure metering pumps are used to deliver fresh oil only to the bearings and cylinders, as was the custom in automobile practice some 10 years ago.

It begins to be more and more apparent that engines of less than 200 h.p. have only a limited field.

Even in the small, high-speed scouting machines which fly from 125 to 140 m.p.h., it has been found necessary to use upwards of 300 h.p.

What we need immediately in America is a large number of training planes, but we also will have to have battle planes driven by motors that are not equal to but superior to those possessed by the enemy. We have always had continually in the past that specter, cost, staring us in the face. A lieutenant in the British Flying Corps said one day last week that there was no question of price at all if a motor would deliver the goods.

[The Stirling-Sunbeam-Coatalen 350 H.P. Aircraft Motor. *Aerial Age Weekly,* Aug 6, '17. 875 words. Illustrated.]

All parts of the Stirling-Sunbeam motor are made in the United States and are so accurately made as to be interchangeable with the motors built in England and used by the Allies. There are 16,000 of the 200 h.p. Sunbeam-Coatalen motors and 3000 of the 350 h.p. motors in production in Great Britain. The Stirling Company is now prepared to supply the 350 h.p. engine in any quantity. The 200 h.p. motor, eight cylinders, weighs 475 pounds; the 350 h.p. motor with twelve cylinders weighs 1058 pounds, and the latter is here described in detail.

The bore is 110 mm. and the stroke is 160 mm. The gear ratio is two to one. The actual delivery of horsepower is 300 at 1700 r.p.m., 332 at 1900, 360 at 2100, and 365 h.p. at 2200 r.p.m. At 365 h.p. the propeller revolves at 1100 r.p.m. Castor oil has been found the best lubricant. The consumption of oil is .04 pints per brake horsepower hour. The crankcase is of aluminum alloy. The upper part carries the bearings complete with caps. The lower half merely acts as a collector for the oil. The upper half weighs 87 pounds and the lower half 17 pounds.

The crankshaft is drop forged and counterbalanced. There are four camshafts, each driven by a set of spur gears; weight of each camshaft four and one-half pounds. Connecting rods are articulated with the auxiliary rod leading. Pistons are cast from a special alloy; weight of each piston, complete with rings, 2 pounds and 3 ounces. Three oil pumps are located on the timing gear end of the motor; two are set in front of tanks, which receive the oil thru a filter and force it to the various parts of the motor, and the third pumps oil from the sump and sends it to the oil cooling tank. Ignition is by four high-tension magnetos, two for each bank of cylinders. The propeller gear weighs 12 pounds and the reduction gear 6 pounds. The propeller used in the tests at Buffalo was 12 ft. 6 in. in diameter, with an 8 ft. 3 in. pitch. An unusually light, compact and effective air starter is provided with each set of six cylinders. This starter weighs only 7 pounds complete.

[The 260 H. P. Mercédès. *Aerial Age Weekly,* Oct 22, '17. 900 words. Illustrated.]

Tests of the 260 h.p. Mercédès engine have given the following figures and data.

When certain minor repairs had been effected power readings were taken from the engine at full throttle from 950 r. p. m. to 1600 r. p. m, and simultaneously fuel consumption readings were taken. During the test the water outlet temperature varied from 75° C. to 81° C. A water brake was used, and this was set to absorb full power at 1400 r. p. m. Average b. h. p., 252. It was noticed that at speeds below 1150 r. p. m. the vibrations were rather excessive. The following details and data were given:

Bore—160 mm. (6.30 in.)
Stroke—180 mm. (7.09 in.)
Piston speed—1655 ft. per min. at 1400.
H. P. per cu.ft. of stroke volume—329.14 h. p.
Direction of rotation of crank—Anti-clock.
Direction of rotation of propeller—Anti-clock.
Type of carburetor—One twin jet Mercédès.
Fuel consumption per hour—152 pts.
Type of magneto—Two ZH6.
Firing sequence of engine—Prop. 1, 5, 3, 6, 2, 4.
Numbering of cylinders—Prop. 1, 2, 3, 4, 5, 6.
Area thru exhaust valves (total)—34.70 sq.cm. (5.4 sq. in.).
Length of connecting rod between centers—326 mm.
Total capacity of each petrol tank—95 gals.
Total capacity of each oil tank—7.25 gals.
Weight of engine, without water, fuel or oil—936 lbs.
Weight of crankshaft, with prop. boss—139.5 lbs.

—Naval Uses of

See also

SUBMARINES—DEFENSE AGAINST—AERONAUTIC
TORPEDOPLANES

[Admiral Usher Outlines Air Defense. *Army & Navy Jour.,* Apr 28, '17. 450 words.]

AERONAUTICS—Continued

Rear Admiral Usher, in command of the Third Naval District, recommends for that district ten aeronautic stations to be located in Connecticut, New York and New Jersey. He points out the need for dirigibles for patrolling. He says a single dirigible of the Zeppelin type could patrol the channel from Sandy Hook to a point 85 miles out at sea better than 72 seaplanes. At the beginning of the war England had only 18 aeronautic stations; to-day she has 107, one-fifth of which are large aeronautic bases. France has about 150 aeronautic stations.

[Aircraft Mother Ships. By Henry Woodhouse. *Flying*, June, '17. 4878 words. Illustrated.]

The naval air service is divided into three distinct, separate branches, whose functions are quite different, and which may be designated as (1) The Offensive Air Service, which consists of the squadrons of seaplanes, stationed on seaplane carriers, and aeronautic bases, which are used for air raids, independent of the fleet; also of dirigibles, which operate from bases; (2) The Auxiliary Air Service of the fleet, which operates with the fleet, using ships as bases; and (3) The Aerial Coast Patrol, which operates from naval stations and naval bases. Naval dirigibles, airplanes and kite balloons have rendered the following services in the present war. They have:—

(1) Attacked ships and submarines at sea with bombs, torpedoes and guns.

(2) Bombed the enemy's bases and stations.

(3) Attacked the enemy's aircraft in the air.

(4) Served as the eyes and scouts of fleets at sea.

(5) Protected ships at sea and in ports against attacks from hostile submarines and battleships.

(6) Defended and protected naval bases and stations from naval and aerial attacks.

(7) Convoyed troop ships and merchant ships on coastwise trips.

(8) Patrolled the coasts, holding up and inspecting doubtful ships, and convoying them to examining stations and searching coasts for submarine bases.

(9) Prevented hostile aircraft from locating the position and finding the composition and disposition of the fleet, getting the range of ships, naval bases, station, magazines, etc.

(10) Located, and assisted trawlers, destroyers and gunners in capturing or destroying hostile submarines.

(11) Co-operated with submarines, guiding them in attacks on ships.

(12) Located mine fields and assisted trawlers in destroying mines.

(13) Served as the "eyes" in planting mines, minimizing the time required for mine planting.

(14) Served as "spotters" in locating the position of the hostile ships and directing gunfire.

(15) Served as carriers of important messages between ships.

(16) Carried out operations over land and sea intended to divert the attention of and mislead the enemy.

(17) Made it possible for commanders to get films of theaters of operation, photographs of the location, composition and disposition of hostile naval forces, and photographic records of condition and of the movements and operations of their own, as well as of the hostile naval forces. Aircraft mother ships are, therefore, most important.

The first extensive use of seaplane carriers occurred on Dec 25, 1914, when the British employed three steamers converted into seaplane carriers to carry the seaplanes to German waters to bomb Cuxhaven, Germany's famous naval base. The report of the Jutland battle established two facts:—

(1) That the German fleet planned its move on information obtained from Zeppelins as to the whereabouts and composition and disposition of the British naval forces.

(2) That the British forces were greatly assisted in their action by a seaplane sent up from the seaplane carrier *Engadine*.

The work of *Engadine* appears to have been most praiseworthy thruout, and of great value. The seaplane used on the British side in the Jutland battle was a "Short" seaplane, equipped with a 225-h.p. Sunbeam motor. The machine was put overboard and taken back on board the ship by means of a crane, which is the only method so far employed in European navies. The two main lessons learned thru this engagement: (1) That it is absolutely necessary to have seaplane carriers with the fleet; (2) That the seaplane carriers must be capable of maneuvering with the fleet, keeping up with it in speed. The squadron which operated in the Eastern Mediterranean, between the time of the landing on the Gallipoli Peninsula in April, 1915, and the evacuation in December, 1915-January, 1916, had several seaplane mother-ships, and many kite-balloon ships.

The report of Sir John Maxwell, general officer commanding in Egypt, recorded that the seaplane carrier *Anne* was torpedoed off Smyrna early in the year, during an armistice, presumably by a German submarine officer who was ignorant of the armistice with the Turks. C. C. Witmer, an American aviator, who trained Russian naval aviators in the beginning of the war, tells of the Russian seaplane carriers as follows: "When the need of aerial protection far from the coast became evident, the Russian authorities took the two fast steamers built for the trade between Odessa and Egypt, fitted them with false decks fore and aft for launching and receiving airplanes, and sent the two ships, with seven airplanes each, to afford the aerial protection needed. These steamers were capable of a speed of twenty knots an hour and seven airplanes could be snugly accommodated on each. The airplanes were launched by lowering them to the water with cranes, and taken aboard the same way. After a little practice, this can be done very quickly. I saw seven airplanes launched and in flight fourteen minutes after the order was given. On one occasion, when the Russian fleet bombarded the Bosphorus, six airplanes,

each equipped with two forty-pound bombs, were launched within fifteen minutes from one of the airplane ships. Forty minutes later they commenced to return to the ship for more bombs. They landed on the lee side of the ship, took their loads—a bomb on each side of the machine, connected to the releasing device—and soared aloft. American aviators were the first to alight on and fly from the deck of a ship. On Nov 14, 1910, Eugene Ely flew from the deck of the U. S. S. *Birmingham,* and on Jan 18, 1911, flew and landed on the deck of the U. S. S. *Pennsylvania,* at San Francisco, also making the return flight from the ship.

The first experiment in starting from the deck of the ship outside of the United States took place on Jan 10, 1912, when Lieut. C. R. Lawson, of the British Army Aviation Section, started from H. M. S. *Africa,* anchored in Sheerness Harbor, in a "Short" biplane, equipped with wheels and skids. Since then all the first and second-class European nations have adopted seaplane carriers and kite-balloon carriers. At the time of the early experiments in launching airplanes from ships in the United States and Great Britain, the world's naval authorities were divided into two camps, one holding that it would be better to make the ship self-sufficient by providing space for launching and landing seaplanes on battleships, with aviators on each ship; the other that it would be better to have regular seaplane carriers, which would supply the entire squadron with an air service. Captain Chambers developed a catapult operated by compressed air, and on Nov 12, 1912, for the first time launched an airplane from a ship in what may be considered a scientific way. Recovering seaplanes at sea is a much more difficult problem to solve than launching the seaplanes, and there is no solution at hand other than hoisting the seaplane by means of the usual boat crane. Ely's landing on the platform erected upon the quarterdeck of the U. S. S. *Pennsylvania* did not bring a solution. That could only be repeated in calm weather and, as we know, war takes place in all kinds of weather. In 1913 Louis Blériot, the French inventor and airplane manufacturer, conducted experiments intended to show the practicability of recovering seaplanes at sea.

The device, consisting of elevated cables to which the aviator was to fly and hook on by means of an automatic clasp connected to the body of the airplane, was tried at Buc, France. Pégoud, the first man to loop-the-loop, flew the light Blériot monoplane to the cable, engaged it with the catching apparatus, the latch automatically grasped the cable, and the machine came to a standstill. This might be repeated under very favorable conditions on board of a ship, but it could not be done under normal conditions, and it does not represent a solution to the problem of recovering seaplanes at sea. The solution rests with the aircraft capable of rising, vertically from the deck of the ship. This suggests the helicopter—and brings forth the problems of making the helicopter efficient. The use of submarines as seaplane carriers is a possibility. According to reports, Germany is building submarines especially for this purpose. The progress in submarine construction has been amazing, and further progress must be anticipated. The *U-53* was 213 feet 3 inches long; displacement, 800 tons; speed (surface), 18 knots; speed (submerged), 10 knots; cruising radius, 10,000 miles; torpedo tubes, 2 forward and 2 aft; torpedoes, 10; three periscopes, and two guns on deck.

—Naval Uses of—Launching Naval Torpedoes from Aircraft

See
TORPEDOPLANES

[To Strike at the German Fleet and U-Boat Bases from the Air. By Rear-Admiral Bradley A. Fiske, U.S.N., Ret'd. *Flying,* July, '17. 2300 words. Illustrated.]

It has been apparent to most impartial students of strategy in this country from the early days of this present war that the probability was that the war would go to the advantage of Germany rather than to the advantage of the Allies. The entry of the United States into the war, which most officers believed from the first to be inevitable, may or may not affect the decision, depending on how wisely, quickly and forcefully we act. If the United States were prepared to throw large numbers of trained troops under trained generals into the field, and to assist the navies and armies of the Allies with great numbers of aircraft, our entry into the war would have an immediate and decisive effect, and perhaps there would have been no war; but we are not prepared to do these things.

Naval officers believe that naval aeronautics can do even more for the Allies now than military aeronautics can, for the simple reason that the paramount danger to the Allies is the German submarine. The coming and going of French and Italian vessels is seriously hindered, and the combined merchant service of Great Britain and the United States is unable to remedy the difficulty. The fighting on land has been going on for nearly three years in almost the same place, with no indication of any approaching change, and no reason to expect any until the submarine menace is abolished. An attack by a large number of German torpedoplanes armed with guns to defend themselves from fighting airplanes would be a powerful menace to the British fleet.

An attack by Allied torpedoplanes, armed with guns to defend themselves from fighting airplanes would be an equally powerful menace to the German fleet, and if made in sufficient numbers, would give the Allies such unrestricted command of the North Sea, even of the shallow parts near the German coast, that German submarines would be prevented from coming out from German ports, the submarine menace abolished, and all chance of German success wiped out.

In air raids over the land, the strategical advantage lies with Germany, because her most important towns, like Berlin, are farther inland than the most important towns of the Allies, like London. For raids on naval vessels, however, the strategical advantage lies with the Allies, because their control of the deep parts of the North Sea enables them to establish a temporary aeronautical base of mother ships sufficiently close to

AERONAUTICS—Continued

the German fleet to enable the British to launch a torpedoplane attack from it on the German fleet in Kiel and Wilhelmshaven, while the Germans could not possibly establish an aeronautical base sufficiently close to the British fleet. It would be possible, provided a distinct effort is made, for the Allies to send a large number of airplane mother ships to a point say 50 miles west of Heligoland; and for a large force of fighting airplanes and torpedoplanes to start from this place about two hours before dawn, reach Kiel Bay and Wilhelmshaven about dawn, attack the German fleet there and sink the German ships. The distance from Heligoland to Kiel is about 90 land miles, and to Wilhelmshaven about 45.

If the German fleet can be disabled, the Allies' navies can countermine and drag out the mines from the shallow waters near the German coast and can then prevent German submarines from getting into deep water, where they can submerge. The elimination of the U-boat menace will be the elimination of the German menace.

—Night Flying

See also

SEARCHLIGHTS—AERONAUTICAL USE OF

[Night Flying. By Henry Woodhouse. *Flying,* Oct 16, '16. 4500 words. Illustrated.]

Night flying started in 1912 when several aviators flew in the moonlight. Now there are hundreds of aviators flying at night in the war zone. A night flying outfit has been developed by the Sperry Company in New York and consists of three stream-lined search lights of 50 c.p. each. Each throws a light beam of approximate 40,000 c.p. thru the use of parabolic reflectors. The lights are mounted near the pilot and can be moved on an axis for use in signaling. The current is supplied by a 150 watt generator driven at 4000 r.p.m. by a wind turbine. A contact storage battery is in the circuit and can be used in case of emergency. The Zeppelin raids forced the various countries to establish night aerial patrols. In order that the aviator may know his position and the altitude of his machine, all of his instruments and each wing tip are lighted by a small electric light and the machine has a search light. Dry batteries usually furnish the current. An aviator wishing to land circles over a field and flashes his code letter and he does not try to land until his call is answered. Thus a pilot can always tell which aerodrome he is near by the answer to his signal. These signals are made by Very pistols or search light. Night flying is of two kinds, that done in moonlight and that done in the dark. In monlight flying, observations can be easily made from altitudes of 9000 feet, but the aeroplane is lost from view from the ground at an altitude of a few hundred feet. Machines in the air at night are not visible from other machines. On moonlight nights at 2000 feet, unlighted objects cannot be seen, yet at 7000 feet roads and lighted motor transports are clearly visible. With no moon at 500 feet, railways, roads and areodromes cannot be seen but all lights can. Parachute flares to light the ground have been used with more or less success, both for lighting up during reconnaissance and for landing. Pilots detailed for night flying should have plenty of practice with the machines they are to use at night. They should be instructed to fly by instruments alone, glide slowly, made side slips and quick recovery, checking the speed of the machine, and turn, using instruments alone and land slowly. There seems to be no method of lighting aerodromes satisfactory to all aviators. The method of using lights on aeroplanes is not satisfactory because if the light burns all the time the aviator is liable to be fired at when the light is seen from the ground. If the light is not used, unless the pilot is skilled in flying by compass, he is liable to be in any location when he flashes on his light, and an aeroplane flying at night with its search light in operation makes an excellent target.

[Night Flying. By Henry Woodhouse. *Flying,* Dec, 16. 1000 words. (Parts 1 and 2 given previously.)]

In order to use the instruments properly at night a luminous compound is painted on the indicators and dials of instruments, which does not interfere with their accuracy or their plainness for daylight readings. When it is dark, however, the various essential points on the dial are set off by the points of glowing light and contrasting darkness and the indicator, which appears like a glowing phosphorescent finger of light, can be plainly seen marking the different points. Such a way of illuminating instruments does not cast a glare of light into the eyes of the flyer. There is nothing to get out of order, because when the luminous compound is applied, it is good on the instruments for years and requires no further attention. Radium luminous material is self luminous and should not be confused with common luminous paints which have been on the market for years. The latter have no practical use for illuminating instruments, as they derive their illumination at night from absorption of light rays during the day. This captured light lasts for about three hours; radium luminous material lasts for years. The only way to be sure you are getting radium luminous illuminated instruments is to test the illuminating compound when it has been protected for at least an hour from the weakest beam of light and when the eyes have accustomed themselves to the dark by being in it for twenty minutes. Radium has a half life of 1750 years; that is to say if we had a gram of radium in 1750 years we would have only one half gram and in 1750 years more we would only have half of that left, etc. It has been suggested that instead of having lights on wing tips of military aeroplanes, blinded spots of self illuminating compound be used. This idea will be tried out. With these illuminated wing tips and maps which are now being used by the Allies abroad, and illuminated instruments, the American aviator would be protected from the enemy's sight as much as is possible.

[Note. *Army & Navy Jour.,* Jan 20, '17. 200 words.]

Twelve flood light projectors have been installed at

Hempstead, N. Y., headquarters of the aviation section of the U. S. Signal Corps, for marking the field for night flying. The chief projector is a 1,500,000 candlepower Sperry searchlight, which has an effective range of 8000 yards. This light will be used for picking up airplanes as they fly over the field looking for a landing place. Also, as the lighthouse of the field, it will serve as a beacon for aviators.

[How German Aircraft Land at Night. *Scientific American*, Feb 3, '17. 200 words.]

To assist the airplane pilot in making a safe landing at night, the Germans have devised the following ingenious plan. A large white light is sunk in a pit in the center of the aerodrome and covered with a sheet of thick glass to withstand the weight of an airplane should the wheels pass over it. At 250 feet from this light, and also sunk in the ground, are four red lights corresponding to the cardinal points of the compass. Each of the red lights is connected by subterranean cables to a wind vane mounted at some convenient point. At night the central light grows constantly, while the red light in the direction of the wind also shows, indicating to the pilot the wind conditions.

—Organization and Administration

Great Britain

[The British Air Ministry. Great Britain's Latest Move to Achieve Command of the Air. By Admiral R. E. Peary. *Flying*, Feb, '17. 3030 words. Illustrated.]

In Jan, 1917, Baron Cowdray was appointed Air Minister. The Air Ministry is charged with the work of supplying the air services of both the British Army and Navy with equipment and personnel. The Allies are reported to have brought down 1800 enemy's airplanes since the war started, 900 during the last year. One of the first actions of the Air Ministry was to eliminate the overlapping of preliminary training for pilots for the two services by doing it all at the same schools. In a speech before Parliament a member said that whatever reductions had to be made due to pressure of finance the air service must be the last affected. England requires aircraft all around her coasts. There is a 1200-mile frontier in India to be defended. More results are obtained from £1000 spent on aircraft than any other expenditure. (An airplane attack on the Donia-Lille main railroad line to intercept traffic at Libercourt is described.) General Pétain on the floor of the Chamber of Deputies said: "I see France in the near future with 50,000 airplanes." In the United States we have not yet 200 military aviators trained or under training and only four aviation stations.

[Progress in Aeronautics. By Major H. Bannerman-Phillips. *United Service Magazine*, Feb, '17. 3200 words.]

There is no reason against having one department charged with the equipment of both the naval and the military flying services, as is now the case in Great Britain. There might be inter-service jealousy to contend with, but that should not be allowed, the committee considered, to hamper a much needed reform. To support this contention, it is pointed out that at the beginning of the war the manufacturing resources open to the two services were divided between them without any possible knowledge of how the division would work out in practice, a division which had, in fact, given rise to many difficulties. It was seen in France how separate equipment departments for each service led to friction, and how the friction ceased when one officer took over the duty for both services, and in the view of the committee a joint equipment department would tend to abolish competition and friction between the services and make for increased efficiency. With regard to the Royal Air Factory, it was considered that its continued existence was essential, but that it should confine its activities to trial and experiment, research, preparation of drawings, repairs, and the manufacture of spars, but should not become a manufacturing establishment.

When we look back at the Royal Flying Corps at the beginning of the war setting out for the front with its hundred or so pilots and its sixty-six airplanes, and with twenty serviceable machines at home for training; when we remember that none of its engines were of British design, and that it was dependent upon the good-will of our French allies for much of its material; and when we see it now, increased out of all recognition in number and efficiency of its airplanes, with their vastly improved engines, its ability to rely upon British manufactures to supply its needs, its training schools, its aerodomes, equipment, pilots and observers, and its army of mechanics, it seems as if the Royal Flying Corps were a new creation.

United States

[Progress of The Aviation Section. *Aviation*, Feb 1, '17. 1500 words.]

Seven aero squadrons for the regular army will, it now seems certain, be organized and equipped before June 30, 1917; but, on account of the difficulty in securing personnel and material, it is doubtful if the twelve reserve squadrons will be organized. Most of the aviators for the regular army and the national guard will be trained at San Diego which now has a staff capable of handling 75 students. The seven air squadrons of the regular army are located as follows: first at Columbus, N. M., second at Manila, P. I., third, fourth and fifth at San Antonio, Texas, sixth at Hawaii and seventh at Panama. Of these the second, sixth and seventh are water squadrons. On account of the difficulty in obtaining airplanes in sufficient quantities, it is now believed that they will have to be ordered at least a year ahead. The aviation section now has a corps of inspectors consisting of a consulting engineer and forty-two inspectors. At least one inspector is stationed at each of the twelve airplane factories now engaged in turning out airplanes for the army. In comparison with the size of the regular army the aviation section bids fair to hold a commanding position by the end of June, 1917. The army will be well equipped with planes. Any increase in regular or reserve establishments must be accompanied by a pro-

AERONAUTICS—Continued

portionate increase in the aeronautical arm. However the personnel is not volunteering fast enough and the material situation needs increased co-operation, co-ordination and standardization.

[Aviation Notes. *Army & Navy Jour.*, Mar 10, '17. 250 words.]

Major William Mitchell, Lieuts. Joseph E. Carberry, Millard F. Harmon, Jr., and Davenport Johnson, all of the Aviation Section, Signal Corps, U. S. Army, sailed from New York, Mar 20, for Paris to act as aviation observers on the French front, where they will look particularly into the organization of the French aviation service behind the front. The French Government's repeated invitation for American aviators to visit their service has not been accepted heretofore because the American aviators have been needed in the big task of thoroly organizing our own air service.

[Joint Air Board Reports. *Army & Navy Jour.*, Mar 24, '17. 900 words.]

What is taken to be a direct recommendation that a separate department be established to supervise the development of the aeronautic arm of defense in the United States is included in a report just made by the Joint Board headed by Chief Constructor David W. Taylor, U. S. N. This board is of the opinion that the development of the aeronautical resources of the United States and the application in war to the maximum national advantage can be accomplished best thru the joint development, organization and operation of the aeronautical services of the army and navy. The coast line and the water areas adjacent thereto will become a theater of joint operations. For this reason the board believes the pilots and observers of both services should be trained together; that joint training stations should be located at or near the coast; that the type of aircraft adopted by the army and navy should be as nearly alike as may be consistent with the service required of each; that the motive machinery and control should be standardized.

The responsibilities and spheres of action may be defined in general as follows:

Army Responsibility.—(a) Aircraft operating in conjunction with the mobile army; (b) aircraft required for fire control for coast defenses; (c) aircraft required for the defense of fortifications, navy yards, arsenals, cities, etc.

Navy Responsibility.—Aircraft operating in conjunction with the fleet, aircraft operating from shore bases for scouting over the sea; (c) aircraft operating under the commandants of naval districts and advanced bases.

[4000 Airplanes and 2000 Aviators Advocated by National Advisory Committee on Aeronautics. *Flying*, Apr, '17. 2830 words. Illustrated.]

There have been trained at Pensacola thirty officers and men of the Naval Militia of seven states. To train equip and organize 2000 aviators, 1000 dirigible balloon operators, and 100 dirigible balloon pilots will require forty to fifty aeronautic centers and thousands of airplanes, hundreds of observation balloons and dirigibles. Great Britain alone has 107 aeronautical stations. Great Britain, like France and Germany, has over 10,000 aviators, about 2000 observation balloon pilots, and 300 dirigible pilots. While the operations of the aeronautic service of the navy will be principally over the water, and those of the army principally over the land, it may be said that a war with a first class power will find the two services constantly operating together. For this reason the pilots and observers of both services should be trained together so that each service may effectively supplement the other in time of need and joint training stations should be located at or near the coast. The National Advisory Committee on Aeronautics defines the army responsibility to be:

(a) Aircraft operation in conjunction with the mobile army.

(b) Aircraft required for the fire control for coast defenses.

(c) Aircraft required for the defense of fortifications, navy yards, arsenals, cities, ship building plants, and other important utilities.

Navy:

(a) Aircraft operating in conjunction with the fleet.

(b) Aircraft operating from shore bases for scouting over the sea.

(c) Aircraft operating under the commandant of naval districts and advanced bases.

The Joint Army and Navy Board has decided there shall be eight aeronautic bases on the Atlantic and Gulf coasts. At present no aeronautic bases are planned for the Pacific coast. Before a meeting of aircraft manufacturers in Washington Dr. Walcott, Chairman of the National Advisory Committee, pointed out that the army and navy would require this year 2000 airplanes and 2000 military and naval aviators, and that 2000 machines would be needed for training pilots and that during 1916 the army ordered 366 planes and received 64.

Whatever the industry produces during 1917 will fall far short of the country's needs. The tentative estimate of airplanes assumed to be possible of accomplishment in 1919 is:

For an army of 1,000,000 men, 1000 planes and aviators.

Attached to our fleet at sea, 200 planes and aviators.

For seacoast defense, 800 planes and aviators.

Total, 2000 planes and aviators.

For training pilots, 2000 planes, 400 aviators.

Actual experience shows that it takes at least nine months to produce a properly trained advanced military aviator, and it costs approximately one and a half machines for each advanced aviator.

—Photography

See

PHOTOGRAPHY, MILITARY—AERONAUTICAL

—Propellers

[Aeronautical Propellers. By Spencer Heath. *Aerial Age Weekly*, Sept 24, '17. 1850 words.]

It is noteworthy that to France we owe the first

publication of screw propeller theory as well as the first public flight of an airplane propelled by that means. In their basic principle screws are the same for whatever purpose used. The air and marine screw are like the cork and wood screw in that they form their own "nut" thru the air or water, but they differ markedly in that the fluid medium thru which they pass has no great stability and yields to the screw in such manner that commonly the screw does not advance its full pitch in one revolution. The differences between air and marine screws may be said to be the reflex of the differences between air and water. Air screws are longer and thinner of blade, lighter in weight of material, larger in proportion to duty and swifter in velocity of rotation and of flight.

The number of blades may be two, three or four. The widest part of the blade is usually at about six-tenths of its radius. The maximum width averages about one-tenth to one-fifteenth the diameter of the screw. In blade outline, however, there is wide diversity. Some designers prefer to approximate a slender ellipse; others prefer the slender ellipse with squared ends on the blades; others approximate a semi-ellipse, the axis of the ellipse proceeding radially from the axis of rotation and forming the trailing edge of the blade. In all forms of blade a common property obtains: The deflection of the blade under load is accompanied by more or less increase of angle in its most effective parts, thus augmenting the pitch. In order that the pitch may remain unaffected by bending or deflection of the blades under load or increase of load it is necessary to dispose the centers of pressure of the sections farthest from the hub on a line curving somewhat rearwardly in the direction of the trailing edge. Nearly every kind of wood has been used in propellers. Walnut and mahogany have long been favorites in Europe. The writer's experience rules out all wood that was not quarter sawed, and points to American quartered white oak as the surpassing material from every standpoint, the particulars of which need not be detailed here.

It is almost needless to say that the wood for air screws is selected and treated with utmost care. The screws are built up by five to ten laminations, according to size. The laminations are laid out on the boards and sawed to outline, care being taken to avoid all defects in wood and to have the grain and density of wood as nearly similar as may be at opposite ends of the same piece. When the separate laminations have been prepared and surfaced to required thickness they are slightly roughened by tooth planing, warmed over steamed coils and assembled together with the best of hide-stock glue and firmly clamped. On the duplicators there is a roller which traverses the surface of the form and guides a high-speed cutter in a manner to remove nearly all surplus wood from the propeller. After the duplicating process the propeller again dries for a few days, after which it is carefully surfaced and balanced by hand and then forwarded to the sanding machine. After sanding there is careful inspection in the white and careful examination of balance, pitch and tracking of blades, hub dimensions, etc. From inspection the propeller passes to the finishing department; here it is first treated with silex filler, then with primer, and lastly with various coats of high test waterproof spar varnish. Balance must be absolutely perfect in all positions; the blades must track within .03 inch. As to the relative merits of three and four blades there is no conclusive data. It is known, however, that in numerous instances the three blade screw, even tho having less diameter, shows marked superiority over the two-bladed *in every particular.* After inspection the propellers are usually packed in standardized pine or white cypress boxes with screwed on covers and heavy battens and iron-bound ends. A center bolt clamps the propeller between battens in the top and bottom of the box, and felt-lined pillow blocks, formed to the shape of the screw, secure it firmly in place.

[A New Method of Testing Propellers. By Gustave Eiffel. *Aerial Age Weekly,* Sept 24, '17. 1382 words.]

A simple graph in my work on the resistance of the air made it easy for one to select a propeller according to its specific thrust and efficiency. However, the values obtained from it for $\frac{Pm}{N^2D^5}$ are usually too low. The reasons for this are that the curves of loading employed by me were not accurate enough. A new method of loading has been employed by installing a dynamo as a brake for the motor driving the propeller. By this apparatus I was able to draw up loading curves for propellers which give the mechanical power on the propeller shaft as a function of the electric power delivered for any number of revolutions. I have verified the accuracy of these curves by a new method of testing by means of which I intend to investigate the result of two propellers, one behind the other. (A revised table according to the new experiments is included in the article.) From the figures given it is possible to select a suitable propeller according to the thrust developed for either airplane or airship. In selecting a propeller at least two conditions should be considered: horizontal flight near the ground, and climbing or flying at great altitudes. The useful power depends on the motive power which depends on the number of r.p.m. Propellers with a small pitch have their r.p.m. reduced to a greater extent in low flying speeds than large pitch propellers. The curves show that it may be desirable to sacrifice motive power to some extent at fast flying speeds by throttling down the motor in order not to exceed the limiting speed of the motor when a small pitch propeller is used. It is to be noted that the reduction in the flying speed near the ground level is roughly proportional to the cubic root of the reduction in the corresponding useful power, while the increase in vertical climbing speed is equal to double the increase in useful power (for machine having an excess power co-efficient of 2).

AERONAUTICS—Continued

—Proving Grounds

[An Airplane Proving Ground. *Army & Navy Jour.*, Jan 27, '17. 250 words.]

The United States Army Aviation School and Experimental Station will be established on Back River, one and three-quarter miles from Hampton, Va. 1169 acres of land have been purchased at $290,000 for the site. Contracts will soon be awarded for buildings costing about $1,500,000, to be followed by other structures, etc., increasing the expenditures to several million dollars. The equipment of the plant will include everything that can possibly be needed in the testing of motors, airplane parts, materials used in the construction of airplanes and balloons, instruments needed in the navigation of the air, and in the testing of new inventions in the science of aviation.

—Reconnaissance by

See also

CAVALRY—RECONNAISSANCE

—Records

See also

AERONAUTICS—ALTITUDE RECORDS AND INDICATORS

[Aeronautics—Records. *Information,* Dec, '16. Quoted.]

At the Mirafiore military aerodrome in Turin, Italy, Nov 9, Lieut. Guido Guidi broke the world record for altitude when he attained a height of 25,800 feet in a flight which occupied one hour and fifty-seven minutes. After ascending 19,750 feet, Guidi's thermometer registered 89 degrees below zero. His record was officially verified.

The previous record, 23,500 feet, was made on Apr 26 by Harry Hawker, an Englishman.

Ruth Law, in a two-year-old obsolete type of Curtiss biplane, flew without stop, Nov 19, from Chicago to Hornell, N. Y., a distance of 590 miles, breaking the American cross-country and non-stop record made by Victor Carlstrom in the modern 200-h.p. Curtiss military biplane, *The New York Times*, on Nov 2. Carlstrom's non-stop distance was 452 miles—from Chicago to Erie, Penn. Miss Law bettered this by 138 miles. Incidentally, she broke the world's record for continuous flight for women pilots.

She completed her flight from Chicago to New York Nov 20, breaking all world records for women flyers. She made the 884 miles from Chicago in 8 hours 55 minutes and 35 seconds.

[Military Chronicle. By the Editor. *Rev. del Circulo Militar*, Mar, '17. 500 words.]

Record distance flight with passenger—Lieut. Antonio Parodi in his Voisin, 140 h.p. made a flight from Palomar to Posadas and return, covering a distance of 2100 kms. It was expected that the trip would be made in two days, but lack of fuel and machine troubles caused delays and two days were required for the return trip.

Lieut. Pedro Zanni attempted to cross the Andes in his airplane, but failed owing to the inefficiency of his machine. A subscription is being taken up to purchase a high grade machine in Europe with which Lieut. Zanni will make another attempt to cross the mountains.

—Searchlights, Use of in

See

SEARCHLIGHTS—AERONAUTICAL USE OF

—Tactics

See also

AERONAUTICS—ATTACK—PROTECTION AGAINST

AERONAUTICS—MATERIEL (Article: "Battleplanes and Aircraft Guns")

[How Airplanes Attack Railroads. *Scientific American,* Nov 3, '17. 500 words.]

British airmen in France recently carried out a successful scheme for intercepting German railroad traffic near Libercourt. Patrols of three airplanes each were first sent out to attack neighboring enemy aerodromes to prevent German airplanes from rising to interfere. Meanwhile, other aviators attacked two trains with bombs, wrecked both engines, and scattered the entrained troops. A large number of the troops were killed or wounded. At Libercourt, station buildings, sidings and rolling stock were hit, some of the latter being wrecked.

—Theory of

See also

AERONAUTICS—DESIGN OF AIRPLANES

[Course in Aerodynamics and Aeroplane Design. By A. Klenim and T. H. Huff, Instructors in Aeronautics, Massachusetts Institute of Technology. *Aviation,* Sept 16, 1916. 10,200 words. Illustrated.]

Skin friction is the resistance of a thin plate moving edgewise thru a fluid. It is due to viscosity resistance and density resistance. Real fluids like air and water offer a resistance to shear, which is a measure of their viscosity. If two horizontal plates are considered and one dragged past the other with a velocity V, and a viscous substance between them, particles of the substance will adhere to the stationary plate. Other particles will move with the other plate. The horizontal force per unit area required to move the plate will be proportional to some constant dependent on the nature of the substance and the velocity.

Elaborate experiments by Dr. Praudtl demonstrate that the viscous drag varies with $V^{1.8}$ for velocities with which we are concerned; the resistance varies as some higher power of V. This extra resistance, due to a turbulent eddying motion of the particles is called density resistance and is proportional also to the area. The total skin friction equals the viscosity resistance plus the density resistance.

(Tables and diagrams are given so that friction can be taken off directly for different areas and velocities.)

The wind velocity, geometrical proportions of the body, density of the fluid, viscosity and the compressibility of the fluid, all enter into the determination of forces acting on a moving body. However compressibility may be neglected in aerodynamical work for bodies in which the resistance is purely of a density or eddy-making nature, as in the case of a wing section at large angles, viscosity does not enter into considera-

tion or is so small that it may be neglected. For stream-line bodies, the resistance is compounded of density resistance and viscosity resistance in varying proportions.

A stream-line body is one that has a gradual change of curvature along any section and which, when moved thru air or water at ordinary speeds, makes little disturbance or turbulent wake. Such a body moving in a viscous fluid would experience mostly frictional resistance. The nose of a stream-line body, coming in contact with a moving fluid, receives a pressure from the moving fluid. This causes the fluid to part and the fluid in turn receives a pressure from the body along its center section. As a fluid passes along the trailing edge of the body it transmits a pressure to the body. The result of this shows that the balance of the work done on the body is zero. At slow speeds in water, almost perfect stream-line motion has been observed. However, at ordinary speeds, even with stream-line forms, there is always a region of turbulence and eddying motion. As a general rule a finer strut has a smaller turbulent region and considerably less resistance, but the fineness ratio must be kept within reasonable limits even from a purely aerodynamical point of view. From the diagram of the fluid motion around a cylindrical body, such as a wire, it will be seen that the resistance will be partly due to eddying or density resistance.

In wing sections we recognize two distinct type of flow; (1) for the small angles up to 6° a steady flow; (2) the turbulent flow which starts at 10° and continues from that point up. The maximum lift is obtained at about 18°.

Illustrations follow showing how to find the resistances of various rudders. The equation for lift is $L=KyAV^2$. In horizontal flight, the lift equals the weight, hence $W=KyAV^2$ in which $Ky=$ a constant varying with the angles of incidence, $A=$ area in sq. ft., $V=$ speed in mi. per hr. A machine traveling fast will require a small value of Ky, and hence a small angle of incidence. Conversely, a slow flying machine will require a large angle of incidence. Sustaining a given weight we can vary angle of incidence, area or speed. The drag equation is $D=KxAV^2$. The higher the value of L/D the smaller will be the drag for a given lift and weight of machine at a given speed and the less power will be required. Hence the ratio L/D is a measure of wing efficiency. A problem is given showing the method of finding the area, drag, maximum speed and total resistance having assumed a monoplane weighing 2000 lbs. and using a R.A.F. 6 wing section.

For all practical purposes, for coefficients of resistance for plates normal to the wind $R=KAV^2$, in which $R=$ resistance in pounds, $A=$ area in sq. ft., $V=$ velocity in mi. per hr. (A table is given showing value of K for various areas.)

The aspect ratio of a plate is the ratio of its breadth to its height when normal to the flow of air. The resistance coefficient increases with the aspect ratio. (A table is given showing values of K for various aspect ratios. Also tables giving values of Ky, Kx and L/D and one giving distance of center of pressure from leading edge of a plate of various aspect ratios.) The curves and tables given are sufficient for reference for the design of flat rudders and elevators. For all plates when turned from zero angle, the lift increases until the critical angle or burble point is reached. Altho the lift drag ratio is not improved for flat plates by increased aspect ratio, plates of large aspect ratio being more sensitive at small angles, are, on the whole more efficient in flight. Plates of small aspect ratio have the critical angle much later and give a wider range of action. For an elevator which does not require a great lifting power, an aspect ratio of three is a fair compromise. For a rudder an aspect ratio of one or two is advisable. If either the rudder or elevator are placed too near the wings large areas for controlling surfaces are necessary. To obviate the necessity for using large forces on the rudder, a balanced rudder is used, that is, one in which the hinge is placed in the center of pressure for small angles.

There is no such thing as a best wing section. There are bad sections giving abnormally high resistance and low lifting power, there are sections giving high lift at large angles of incidence but too great resistance at small angles, and others that give a very stable motion of the center of pressure but sacrifice aerodynamic efficiency.

The selection of any particular type depends upon the performance required of the machines in view. The various sections, used as representative types, have been obtained by experiment by Eiffel and N. P. L. laboratories. As we shall see later the hollowing out of the lower wing has little importance, but the lift is increased about 17% where a plane lower surface is cambered out to a camber of .06. However, an increase in lift obtained in this way involves a dangerous weakening of the wing. The maximum ordinate is best placed about 3/8 of the chord from the leading edge. (Tables and illustrations give the maximum lift and drag values for various wing sections and angles of incidence.) The lift coefficient is unaffected by variation in the product L (= span of the wing in feet) times V (= velocity of relative wind in ft. per sec.), but the drag coefficient and the lift over drag ratio are both improved by the increase of LV. Hence as most of the tables were made for a lower velocity than actually encountered in practice, a designer will be proceeding on a very conservative basis. The needs of machines vary, for altho a large heavy battle plane or flying boat requires a big lift coefficient, the small reconnaissance machines require a small value of lift at best ratio for L/D. The maximum lift should occur at as high an angle as possible so as to give as large a speed variation as possible. The maximum angle of lift is known as the burble point. The shape of the lift curve at this point determines whether or not the machine is easy to stall. A wing with a flat lift curve at the burble point will not lose its sustaining power very rapidly. The movement of the center of pressure is important at low angles. If the center of pressure moves backward at low angles, the machine will have a tendency to dive. This is provided for in modern machines by fixed stabilizing surfaces. The ideal wing

AERONAUTICS—Continued

would give great lift and efficient climb, high efficiency in normal flight, and high efficiency at maximum speeds. It is important that at the points where wing spars are placed, the wing should have sufficient thickness to permit the use of reasonably deep spars without exaggerated width. A wing may indeed have sufficient thickness at two points for good spars to be placed, yet these points may be too close together or too far apart for a strong construction. A slight variation in the profile may introduce considerable changes in the aerodynamic properties of a wing. Experiments must be conducted at laboratories in wind tunnels in order to obtain the aerodynamic properties of a wing for each change in camber, position of maximum ordinate and thickening of leading and trailing edges. (A table follows showing values of *L/D*, angle of incidence for maximum *L/D*, maximum value of *Ky* and angle for maximum value *Ky* for different wing sections.) As a general rule it may be stated that when the angle of incidence decreases, the center of pressure on a wing moves back and the resultant force tends to cause the machine to dive; when the angle of incidence increases the center of pressure moves forward and the resultant force tends to stall the machine. In order to limit the motion of the center of pressure, wings have been designed with a slight reverse curvature at the trailing edge. The results of tests for various reverse curves show that with an elevation of the rear edge of about .037 of the chord, the center of pressure can be kept stationary but with a loss of 12% of the maximum *L/D* and 25% loss of the maximum lift. It appears from experiments that thickening the wing toward the trailing edge does not affect the lift coefficient at a given angle of incidence greater than 7° and at smaller angles the lift coefficient is actually a little greater. This thickening is done for structural reasons. As the aspect ratio increases, the maximum *L/D* ratio improves, the drag diminishes, the lift coefficients at all except very small angles remain practically constant and the angle of no lift occurs at smaller positive angles. In designing aeroplanes and selecting the best aspect ratio it is necessary to consider the structural strength of the machine as well as its aerodynamical properties. The increase in the aspect ratio is limited, because as the span of the wings increases, the heavier the structure becomes for the same strength. The standard practice of design fixes the aspect ratio at 5 to 1 for monoplanes and small biplanes, and 6 to 1 or 7 to 1 for large biplanes.

In order to secure stability, fore and aft, certain manufacturers have swept back their wings. Experiments show that stability is thus only partially secured, for at small angles the center of pressure moves forward, checking diving, but at large angles the center of pressure again moves forward thus tending to stall the machine. A negative tail can convert a diving moment into a stalling moment at small angles, and at large angles the negative lifting surface will become positive and may be used to convert a stalling moment into a diving moment. Similarly in a machine with swept back wings and negative wing tips longitudinal stability can be secured, but the negative surfaces having such a small arm compared with the negative tail surface must have a much larger surface. The large surface makes the arrangement aerodynamically inefficient.

In order properly to investigate pressure distribution, it is necessary to have an understanding of the variation of stresses in the covering fabric of a wing, the great efficiency of a cambered surface as compared to a flat surface, an analysis of the forces present, the relative importance of the two surfaces of the wing, the effects of varying aspect ratio, and the variation of lift and drift with speed and size of the model. The pressure distribution is taken by reading direct from holes made in the wing. (Method explained and compared with theoretical values.) Experiments show that lift coefficients are scarcely affected by changes in speed and size; with ribs, stringers, fillers and good fabrics employed, the stresses produced are well within the limits of safety. At an angle of incidence of 6 degrees and a speed of 60 mi. per hr., pressure may vary from 13 to 8 lbs. per sq. ft. By putting greater strains on a machine the loading may become much greater. At the sides of the wing section, there is a considerable amount of lateral flow which prevents the establishment of a regime as efficient as at the center where the air does not escape but follows the natural contour of the wing. As the aspect ratio is increased, the inefficient action of the exterior sections assumes less importance. These results of experiments show what may be expected when a wing is varied in plan form, and tend to explain the effects of raking. (Diagrams are given showing curves of equal pressure for various wings.) The upper surface of a wing is by far the most important. The hollowing out of a wing section has very little effect either on its lifting power or efficiency. (Curves are given showing this.) A wing section is so much more advantageous than a flat plate because the suction on the upper surface of a wing toward the trailing edge is much greater than that for a flat plate and the portion of the force on the upper surface is due to the suction in the region of the leading edge. A wing will thus give a greater lifting power and a greater lift-to-drag ratio than a flat plate.

[Aerodynamical Properties of the Triplane. By J. C. Hunsaker. *Aviation,* Nov 1, '16. 3200 words. Illus.]

The increased size and weight of aeroplanes require an increase in the landing speed. If the wing loading is kept at about 5 lbs. per sq. ft., the wing area, for an aeroplane weighing four times as much, must be four times as great. Such a span eliminates the monoplane, gives the biplane enormous dimensions, and brings into consideration the triplane. Investigation shows that the triplane is not so effective as the biplane and requires more power to drive. At small angles near 4 degrees for the same lift, the triplane requires 6 per cent. more power than the biplane of the same span. At 4 degrees incidence the ratio of lift to drift is 13.8 for the biplane against 12.8 for the triplane. An account of experiments on models in the wind tunnel at the Massachusetts Institute of Technology is given. It appears from these experiments that the upper wing of the triplane is the most effective

and the middle wing least effective of the three. The very poor lift of the middle wing must be caused by interference with the free flow of air due to the presence of the upper and lower wings. Excepting at the critical angle, the lift coefficients observed for the biplane and calculated for a similar biplane from the lift on the upper and lower wings of the triplane, are in perfect accord.

[Course in Aerodynamics and Airplane Design. By A. Klemin and T. H. Huff, Massachusetts Institute of Technology. *Aviation,* Nov 15, '16. 1800 words. Illustrated.]

Monoplane surfaces are areodynamically better than biplane or triplane surfaces, but as the surfaces increase in size to carry greater weights, the monoplane cannot be made strong enough, and the biplane must be used. Other important considerations in biplane construction are staggering the wings in order to obtain longitudinal stability, for convenience of construction and increasing the length of the beams. The angle of decalage is the small angle between the planes. Experiments with orthogonal biplanes, that is, those in which the lines joining the leading and trailing edges of the two wings are both at right angles to the chord, have demonstrated the following: drag per unit area of biplane combination was not appreciably greater than that of a similar monoplane surface; the lift coefficients as compared with a monoplane surface decreased considerably, and the loss was the greater the smaller the ratio between the gap and chord; the value of lift over drag increases with the ratio of gap to chord; the percentage of lift on the upper and lower wings on the biplane varies with the angle of incidence. At zero degrees the lower wing has about 30 per cent. of the lift; this increases at 12 degrees to 46 per cent. Authorities agree that about 55 per cent. of all forces act on the upper plane.

Static stability tends to bring the aeroplane back to a position of equilibrium. This righting moment may be so strong that the airplane may move in the opposite direction and thus an oscillating movement be started; in fact the greater the static stability, the more violent the oscillations. Dynamic stability is supplied by large tail surfaces and damps out the oscillations which the static stability alone is unable to subdue. A large degree of static stability can be obtained at the expense of loss in efficiency by employing reversed curves at the trailing edge of the wings. It is also possible to insure static stability by the employment of biplane combinations with stagger and decalage. Dynamic stability without preliminary static stability is impossible.

Experiments have determined that static longitudinal stability can be obtained with but little loss in aerodynamic efficiency and the lift curve at the burble point can be flattened out and made to maintain its maximum for a wide range. In order to judge of the stability of any combination, it is necessary to assume a number of positions for the center of gravity and normal flying angle of incidence, and to see whether displacement from normal flying position is followed by the correct righting moment about the center of gravity. Stagger alone improves the aerodynamical qualities of a biplane, but does not increase the stability to any appreciable extent. Cutting down the lower wing of a biplane does not improve the stability, but it improves the aerodynamic efficiency. Increased decalage combined with stagger produces progressive stability but at the expense of aerodynamic efficiency. Reversed curved wings give static longitudinal stability, but the maximum lift is 17 per cent. less than for a simple orthogonal biplane. With a stagger decalage combination there is an actual increase in the maximum lift. Constructional difficulties in the region of the rear spar are avoided. On the other hand stagger involves increased length and resistance of wing struts. The relative merits of the two systems can be determined only by practical comparative experience of the two types. In the author's opinion, the stagger decalage system is more likely to give better results than the reversed curvature wings for ordinary machines. (Tables are given comparing monoplanes and biplanes with various stagger, lengths of chords, decalages, showing minimum lift, and maximum lift over drag for the same increase of incidence.) From this it is concluded that the biplane has a very distinct advantage for a high speed scout. Apparently at a high speed, the biplane resistance is about ten per cent. less than the monoplane resistance. For a slow machine the biplane resistance is 15 to 20 per cent. greater than the monoplane resistance.

[Course in Aerodynamics and Airplane Design. By Alexander Klemin and T. H. Huff, Instructors in Aeronautics, Massachusetts Institute of Technology. *Aviation,* Dec 15, '16. 1500 words.]

One of the most difficult problems in aeronautical design is the prediction of the total resistance of the machine. If airplane bodies were designed from a purely aerodynamical point of view, they would follow dirigible practice and be of stream-line form. There are, however, a number of structural requirements which have to be met, which preclude the employment of such forms. The body must enclose the power plant and the personnel, the length must be great enough to place the rudders clear of the wash of the planes. The shape of the body must conform to structural requirements, such as the use of four longitudinal girders or a triangular form which has been found to be advantageous in steel construction. The propeller in a tractor machine also introduces three possible variations in drag coefficients: (1) the propeller is pulling and there is a slip stream of velocity greater than the airplane velocity; (2) the resistance on a glide, when the engine is shut down but the propeller is revolving as an air motor; (3) when the propeller is not revolving at all, the engine being held. (Table is given showing the resistance coefficients of a number of airplane bodies.) Exact comparison is impossible because some of the bodies are made for two men and others for one. The resistance of the body in an airplane is apparently a small quantity, but figures given do not represent the resistance of a body in full flight where it is increased by 40 per cent, the propeller slip stream increasing the relative speed of the air by some

AERONAUTICS—Continued

25 per cent. Also it must be remembered that with a best glide of 1 in 8, a 5 pound increase in resistance is practically equivalent to an added weight of 40 pounds. The blunt square form of body such as is often seen in American practice may increase resistance even more, and better aerodynamical design of bodies seems a feature worth considering. A pusher body gives a much smaller resistance than the tractor bodies, but when the head resistance of the uncovered outriggers is taken into account it will probably be found that the pusher arrangements offer considerably more resistance than the tractor bodies. Fittings are so variable in design that it is impossible to give definite figures to meet every type of wing-strut fitting. Tests conducted at the Massachusetts Institute of Technology on the fittings, of which dimensions are shown, for two types at 60 miles per hour, give 1.07 and 1.44 pounds respectively. For a standard airplane wheel of about 26 x 4 inches in size, the drag was found to be about 17 pounds at 60 miles per hour. The important result found was that an uncovered wheel had a resistance of 50 per cent. more than a covered wheel of similar dimensions (curve is given showing the resistance of wires for different plotting methods). When the question of resistance first began to arouse interest, it was popularly supposed that a vibrating wire had much greater resistance than a stationary one. This, however, is not the case. Research on this point has failed to disclose any difference whatever, altho the balance would have shown deviations as small as 3 per cent. even for the extremely small forces under consideration. The resistance of stranded wire was also investigated and it was found to be about 20 per cent. greater than for a smooth wire of the same diameter (table is given showing resistance of two wires placed in various positions). From this it is seen that two wires placed one behind the other and spaced from 5 to 9 diameters apart have from 60 to 75 per cent. more resistance than a single wire. The resistance is however, materially less than for the two wires placed side by side. It has been suggested that wire resistance should be decreased by stream-lining or adding a triangular portion in back of the wire. From experiments, however, it appears that a section made up of a semicircle and a triangle has a decidely high resistance and the gain from such procedure would be small.

[Scientific Research for National Defense as Illustrated by the Problems of Aeronautics. By Lieut.-Colonel George O. Squier, Signal Corps, U. S. A. *Journal of the Franklin Institute,* Jan, '17.]

In an address delivered before the National Academy of Sciences, Boston, Nov 14, 1916, certain problems connected with the development of Military Aviation and Aerostation were discussed. These problems are, very briefly, as follows:

I. AERODYNAMICS

(a) The development of the theory, and the determination of the value of numerical factors for correcting laboratory coefficients so as to arrive at accurate values in actual design.

(b) Speed and direction of flow of air about geometric and aerotechnic forms.

(c) Mapping the currents of the upper atmosphere.

(d) Fuller explanation of soaring.

(e) Development of the equations and laws by which the behavior of large aircraft may be more accurately told from the test of models.

(f) Investigation of better methods of securing a lift or thrust in the air from the consumption of fuel.

(g) Completion of the theory of the air-screw

II. ENGINE PROBLEMS

(a) The most immediate problem is that of fuel; one that will carry more power into the engine per unit volume will be a direct gain.

(b) Solid fuels that can be converted into liquid just before using are desired in military aviation.

(c) The problem of radiation with reference to some substance that would circulate thru the cooling system at higher temperatures than water.

(d) Tubing that will resist vibration is desired. This kind is important, not only for tubing, but for tanks. A fabric and rubber tank that really would resist the action of gasoline would be of the highest benefit.

(e) A material is desired that would really prevent dangerous corrosion of the metal parts.

(f) The noise made by aircraft in motion should be eliminated if possible.

III. MISCELLANEOUS

(a) The effects of low density air at high altitudes on the performance of pilots.

(b) Transparent wing covering combining certain qualities such as resistance to flame, and stretch; action of moist air, etc.

(c) The development of light alloys for airplane construction. So far, no alloy has been found comparable with Alaskan spruce in "specific tenacity."

(d) The investigation of the character of eddy-formations caused when wind strikes trees, cliffs, etc., and the character of disturbances created by cañons, deserts, swamps, etc.

(e) Radio apparatus for aircrafts.

(f) Automatic devices for controlling airplanes.

(g) Bullet-proof gasoline tanks.

(h) Development of the fabric for covering airplanes.

(i) Devising non-inflammable and protective clothing for aviators.

(j) Ground-speed indicators to measure speed of aircraft over the ground.

(k) Photography.

IV. PHYSICS OF THE AIR

(a) High frequency.

(b) Elasticity.

(c) Friction.

(d) Mass.

[Course in Aerodynamics and Airplane Design. By Alexander Klemin and T. H. Huff, instructors in aeronautics, Massachusetts Institute of Technology. *Aviation,* Jan 1, '17. 1400 words. Illustrated.]

In order to determine a single expression that will give general efficiency and theoretical desirability of

any strut section, it is necessary to start with some basic assumptions. The staff of the National Physical Laboratory, in order to give their expressions, assumed a machine with a speed of 60 miles an hour and gliding angle of 1 in 7, and the average width of the struts about 1 inch. Since the gliding angle is equal to W/R. every seven pounds of strut weight will give rise to 1 pound of resistance, in addition to the aerodynamic resistance of the struts. We can therefore write $T=W/7+R$ where T is equal to the thrust due to the struts and R their aerodynamic resistance. Simplifying, we have $C=W+7R$. This expression has a maximum value for the least efficient strut. Therefore the reciprocal is employed, and multiplied by the constant 14,300, gives $C=14{,}300/W+7R$. The best strut under the conditions above specified is the one then showing the highest value for C. If the speed of the machine is greater than 60 miles an hour the resistance becomes of greater importance as compared with the weight. If it becomes necessary to use struts having a diameter of more than one inch, the advantage inclines toward the sections which have the greatest strength for their weight and the relative importance of resistance is diminished. The strengths of two struts are considered to be equal where there are moments of inertia about their longitudinal axes that are equal. (A table is given showing the dimensions, the moment of inertia, the resistance in pounds of a hundred feet of strut at 60 miles an hour and the weight in pounds of the spruce strut of various sections as determined by Mr. Ogilvie.) From the above it appears it would be the best practice to run the sides of the strut parallel for some little distance before taking in the streamline. However, these parallel sides should not be made too long, for the very longest sections do not give such low resistance as those of moderate form.

The resistance is little affected by the chopping off of a portion of the tail in such a manner as to leave it straight across. This is because in a section of air flow about a fair shaped section the lines of flow always leave the contour of the strut some distance short of the extreme edge (another table is given showing the cross-section of the struts, moment of inertia, resistance in pounds, weight of 100-foot sections for the struts used in various machines such as De Havilland, Farman and B. F.). The length of the strut is less important than was generally supposed a few years ago, while its effects are largely determined by the nature of the surfaces in which the strut terminates. From results of experiments carried on by Mr. Thruston, it appears that the effects of the length are practically negligible when the length is more than 50 times the thickness; since the struts never have free action, the resistance may be considered as independent of length thickness ratio for all purposes of design. The form of air flow about the wing may have very decided effects on the resistance of interplane struts, but we have no means of knowing how great these are. (Curve is given, showing the ratio of resistance of the strut inclined at various angles to the resistance of a normal strut of like section and equal projected length.) From this it is seen that the resistance at 30 degrees to the wing is less than that of 90 degrees. This difference is by no means accounted for by the difference in length of section parallel to the wind. The resistance coefficient is not an absolute constant, but is a function of VD where V is the speed and D the diameter of the strut. The coefficient tends to decrease as VD increases, but the change for value of VD above 6 is extremely small. We can therefore deduce from experiments that it is safe to reduce the values for resistance (as given in N. P. L. tests) by about 25% in applying them to a design. The corrections given here should only be applied to struts of fairly good section, for the value of VD has a much less effect on those sections for which the resistance is relatively high and in which there is more effect due to turbulence than to skin friction.

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The resistance offered by an airplane in flight to the passing air is called parasite resistance. This parasite resistance is composed of the resistance of the struts, wings, rudder and elevators, body with pilot and passenger, axle, skids, wheels and wing, wiring, etc. Added to the actual resistance is a per cent increase for ship stream. The parasite resistance for certain airplanes is shown below:

Airplane.	Weight.	Engine.	Parasite resistance coefficient, PV= mi. per hr.	Resistance in lbs. at 60 mi. per hr.
B E 2	1650 lbs.	70 HP.	$P=.038\ V^2$	140
Curtiss	1893 lbs.	90 HP.	$P=.035\ V^2$	126
Martin	1800 lbs.	70 HP.	$P=.042\ V^2$	151
M. I. T.	1850 lbs.	90 HP.	$P=.032\ V^2$	115
Sturtevant	2650 lbs.	140 HP.	$P=.0576\ V^2$	212

The simplest method of determining the slip-resistance is to increase the total structural resistance by 10 per cent. This is in accordance with tests in the field. For a monoplane the increase is 15 per cent, for the parts exposed bear a larger ratio to the rest of the machine. In designing machines it is better to select parasite resistance coefficient from a machine of similar design and weight than to use any rules that are only roughly correct.

Altho constructors have heretofore built only one type of airplane—the tractor biplane reconnaissance machine—there are now six distinct types that they should follow in their constructions. These types are: 1. Land reconnaissance machines used where there are no enemy airplanes. 2. Land primary school machines. 3. Land advanced school machines. 4. Land gun carrying machine. 5. All around twin engine land or water. 6. Land pursuit type.

The unarmed pursuit machine is a wrong development, for it can be used only against an enemy who has no airplanes, it will be outmatched in warfare by the large armed twin-motored machine and for short ranges the pursuit type will surpass it. The best ma-

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chines of this type are: Standard H 3, the Curtiss R 4, the Wright-Martin V, the Sturtevant S, and the Wright-Martin R. The HP. of the engines varies from 135 to 200 and some have six and some eight cylinders. The climb in 10 minutes varies from 3500 feet to 4000 feet and the empty machines from 1725 lbs. to 2500 lbs., with a useful load from 700 lbs. to 1020 lbs. The average gross weight of these machines is 2957 lbs.; wing area 493 square feet; HP. 155, and endurance 5.65 hours. The average maximum speed is 86.50 miles per hour; minimum speed 45.75 miles per hour, and climb in 10 minutes 3666 feet.

The primary machine is a steady slow type, in which a student finds it easy to acquire confidence. The advanced training machine is very similar to the reconnaissance type only somewhat slower. The following are the most important features of the two types of training machines as outlined in the Specifications of the Aviation section of the Signal Corps:

	Primary.	Advanced.
Useful load	pilot and passenger	pilot and passenger.
Gas and oil	three hours	four hours
Motor	70-90 HP.	90-110 HP.
Min. speed	37 mi. per hr.	43 mi. per hr.
Max. speed	66 mi. per hr.	75 mi. per hr.
Climb 10,000 ft. fully loaded in	2 hrs.	75 min.
Climb in 10 min.	2600 feet.	3000 feet.
Landing gear	3 wheel type.	2 wheel type.

A typical machine of the advanced training type is the J. N. 4-B Curtiss tractor. This machine has a 90 H.P. motor, maximum speed 75 miles per hour, minimum speed 43 miles per hour, and can climb 3000 feet in 10 minutes.

The land pursuit machine had assumed a most important part in the present war. This type of machine by virtue of its tremendous speed and climbing ability can dodge and outmaneuver its larger enemy, maintaining an effective fire with its machine gun, at the same time presenting a small and bewildering target. Listed below are the features of some of the prominent European and American pursuit machines:

	Nieuport.	*S. P. A. D.*	*Curtiss Triplane.*	*Blériot.*
Engine	80 H.P. Le Rhône	150 H.P. Hispano-Suiza	Curtiss OXX 2 100 H.P.	150 H.P. Hispano-Suiza
Number of men	1	1	1	1
Endurance	2½ to 3 hrs.	....	2½ to 3 hrs.	....
Max. speed	....	125 mi. hr.	125 mi. hr.	125 mi. hr.
Min. speed	....	....	56 mi. hr.	....
Climb 10 min.	7000 ft.	9200 ft.	10,000 ft.	9200 ft.
Weight	....	....	1218 lbs.	....
Useful load	....	460 lbs.	....	460 lbs.
Span top plane	24′ 6″	....	25′ 0″	....
Chord	3′ 11″	....	2′ 0″	....

The guns on the pursuit machines are either fired, thru the propeller which is suitably protected to deflect stray bullets or fired thru the propeller with a suitable synchronizing mechanism or placed on the upper plane and fired over the propeller.

As there has been no land gun-carrying type of machines as yet built in the United States, the features can best be taken from the German machines listed below: [see table on following page]

At the present time the twin motored machine is more or less experimental, but the following features are very desirable:

H.P.	260
Number of men	2
Military load	550 to 1100 lbs.
Fuel pounds	600 to 1100 lbs.
Miles full power	450 to 600
Climb 10 min.	3400 ft.
High speed	90 mi. hr.
Low speed	47 mi. hr.

The most difficult problem of all manufacturers is to estimate the weights of any proposed machine and the manufacturer who has kept a careful weight schedule for a number of machines has valuable data in his possession. The weights listed below are for the standard H. 3—130 H.P. Maximum speed 54 miles hour; minimum speed 46 miles per hour; weight bare 1908 lbs., loaded 2651.9 lbs.;

Parts.	Weight.	Percentage of whole.
Body	302 lbs.	11.4 %
Chassis	138.5 lbs.	5.23
Upper wings	178 lbs.	
Body wing section	16.5 lbs.	
Lower wings	190 lbs.	
Total wing group	384.5 lbs.	14.52
Interplane struts, fittings, wires, &c.	107.6	4.06
Tail surfaces	53.3	2.0
Controls	30.6	1.15
Gas and oil 6 hrs.	429.5	16.2
Tanks	78.5	2.95
Engine propeller and radiator and water	738.8	27.77
Passenger and pilot	330.0	12.5
Equipment	68.6	2.20

	Rumpler Mercédès	Aviatik Mercédès	L. V. G. Mercédès
Engine	165 H.P.	170 H.P.	170 H.P.
Max. speed ground	92 mi. hr.	93 mi. hr.	95 mi. hr.
Speed at 1000 meters	....	84 mi. hr.	87 mi. hr.
Speed at 2000 meters	85 mi. hr.	82 mi. hr.	84 mi. hr.
Climb in ft. per min	3200 in 10	3200 in 9½	3200 in 12
	9600 in 29	6400 in 21½	6400 in 33
Max. altitude loaded	14,800	11,200	10,000
Endurance loaded	4 hrs.	4½ hrs.	4½ hrs.
Weight	2780 lbs.	2840 lbs.	2840 lbs.
Useful load	950 lbs.	980 lbs.	980 lbs.
Length	25 ft.	....	26 ft.
Span upper wing	39 ft.	41 ft.	41 ft.

When a rapid estimate is needed the following rules may be used:

1—For small biplane with a total weight of 1200 lbs., the body should weigh about 70 lbs.; for 2500 lbs. total weight, 180 lbs.

2—Seating, 10-12 lbs. per person.

3—Single control, 30 lbs.; dual control, 50 lbs.

4—Landing gear, 1/6 total loaded weight of machine.

5—Tail skid, 1/20 weight landing gear.

6—Main planes, 76 lbs. per sq. ft. of wing area.

7—Control surfaces, 5 lbs. per sq. ft.

8—Tanks, 75 lbs. per gallon.

9—Engine and fuel, given later.

10—Engine mounting, 1/12 of engine weight.

11—Propellers, 2.5 h.p.

12—Radiators, to be given later.

13—10 lbs. added for aviator's costume.

14—10 lbs. for instruments; 8 lbs. fire extinguisher; 5 lbs., tool kit; 5 lbs., first aid kit.

15—Cables, wheels, turnbuckles, wires, ropes, etc., will be treated later.

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Materials in Airplane Construction—Within the limits of one section it is impossible to treat adequately all the data on materials required for airplane construction. For practical work, the designer must procure all necessary handbooks, make tests of his own special fittings, and generally collect his own data. It is the remarkable strength for its weight which makes wood so useful in airplane construction. If we compare spruce, weight per cubic foot 26 lb., tensile strength 9000 lb., with mild steel weighing 490 lb. per cubic foot with a tensile strength of 60,000 lb., the spruce will be $9000/60{,}000 \times 490/26 = 2.9$ times as strong for the same weight. The weight of wood varies greatly for the same species and for portions of the same tree. Sapwood is heavier than heartwood, summerwood than springwood. Green timber naturally weighs more than dry timber, due to the presence of sap and moisture. The ultimate wood fiber of all species has a specific gravity of 1.6, so that no wood would float in water were it not for the buoyancy of the air present in the cells and walls. Weight is a good indication of the strength of wood, provided the amount of moisture contained is known. As a general rule, we may say that a comparison of two woods, each containing the same percentage of moisture, will show the heavier to be the stronger; in fact, the strength will be very nearly proportional to the weight. The strength properties of wood depend on (1) correct identification of species and variety; (2) age and rate of growth; (3) position of test specimens in the tree; (4) moisture content; (5) relative freedom from defects, such as knots, etc. Tensile tests are difficult because tests cannot be devised that do not involve either shear along the grain or compression across the grain. Failure in tension along the grain involves principally the resistance offered by the wood elements to being torn apart transversely or obliquely. Knots weaken wood subjected to longitudinal tension. Compressive strength depends on a number of factors: (1) density; (2) strength of union between individual fibers as affected by moisture content; (3) stiffness of wood fibers; (4) continuity of the course of longitudinal strands in a direction parallel to axis of the piece. The strongest woods in compression with the grain are, roughly, in the following classes: (1) The dense and tough hickory, birch, hard maple, etc.; (2) oak, elm, ash; (3) spruce, pine and fir. Crushing strength across the grain is dependent practically entirely upon the density of the wood. In considering the strength of a wooden beam in bending, several difficulties occur. Longitudinal shear is very important. A wing spar may be amply strong in bending, and yet, if highly channeled out, fail by longitudinal shear. As a matter of fact, the elastic limit of the material may have been shifted, and the extreme fiber may be no longer proportional to the bending. Knots originate in the timber cut from the stem or branches of a tree because of the encasement of a limb, either living or dead, by the successive annual layers of wood. A sound knot is usually harder than the surrounding wood, and in coniferous woods is apt to be very resinous. On this account it may constitute a defect because of its non-retentivity of paint or varnish. A knot constitutes an impediment to the splitting of timber, since the fibers of the stem wood above a limb bend aside and

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pass around the limb, while the fibers below run continuously into the limb. Loss of moisture does not affect the strength of wood in any way, until the total moisture content has been reduced below the critical percentage, which represents the fiber-saturation period. Thus the strength of green wood is only 50 to 60 per cent of normal air-dry conditions (12 per cent moisture), while the strength of kiln-dry wood exceeds the strength of air-dry woods by some 50 to 70 per cent. Timber differs from most other materials in that small variations in the rate of application of load have a more pronounced effect upon the strength and stiffness shown by a specimen under test. A certain type of timber may be most suitable for the direct stress to which it is subjected, yet fail completely under certain indirect stresses, either inherent in the construction or due to faulty design. In no material are such conflicting values given by various authorities as for timber. The size of the specimen under test, the dryness, the method of applying the load, and its previous history, all tend to introduce discrepancies.

The following terms are in common use: (1) "Solid wire stay" or "aviation wire" of one wire of suitable diameter; (2) "strand stay," consisting of either 7 or 14 wires stranded together and known to the trade as "aviation strand"; (3) "cord," or "rope stay," consisting of 7 strands twisted together, forming a rope, the strands being either 7 wires or 19 wires; (4) "flexible cord," composed of six strands of seven wires, with a center of either cotton or wire, as ordered. A stranded or cord stay has about 20 per cent more aerodynamical resistance than a solid wire of about the same diameter. There appears to be a slight advantage in favor of solid wire as regards strength of stay. On the other hand, the strand stay is one and a third times more elastic, the cord one and three-quarter times more elastic than the solid wire. The breaking strength of turnbuckles made of precisely the same material will vary enormously with every type of construction, and the makers' catalog or data sheet has to be consulted for every special case. The steel at present in common use among manufacturers is the mild sheet steel generally designated as cold rolled steel (C.R.S.). It is a relief to find that the constructors and the Government are endeavoring to do away with this most unreliable and inefficient of materials. Instances have only too often been brought to our attention, when upon the completion of some small stamped fitting, the apparently solid metal is found to be of two distinct layers of thinner metal held together only at a few points.

The matter of weldability of the chrome vanadium and nickel steel is indefinite, very reliable information showing that 3¼ per cent nickel steel gives better welds than the chromium steel.

Steel Rivets and Pins—If the crushing strength of the rivet is greater than its shearing strength the design should be based upon the smaller result. In case the bolt is subjected to a load other than tension, the strength should be based upon the corresponding form of loading. The strength of United States standard bolts may be based upon the formula $P = A \times ft$, where P = the strength of the bolt, ft = tensile fiber stress per square inch = 65,000, A = effective area at root of thread. Solving for D the nominal diameter $D = 1.24 \sqrt{P/ft} + .088$.

The general requirements and tests for airplane fabrics are well summarized by the following table:

(1) Fabric should present reasonably great resistance to flame.

(2) It should be proof against the action of salt water, moist air, extreme dryness, quick changes of temperature.

(3) It should not stretch in any direction.

(4) It should have a tensile strength of at least 75 lb. per inch width in any direction.

(5) The tendency to tear and split because of tacks, bullets, etc., should be almost nil.

(6) The weight should be taken in an atmosphere of 65 per cent relative humidity at 70 deg. Fahr.

(7) The weight, yarn number and tensile strength of the fabric should be obtained when it is in a bone-dry condition, i. e., after it has been subjected to a temperature of 221 deg. Fahr. for two hours.

(8) Identity and average length of fibers should be ascertained.

(9) Determination should be made of the percentage moisture "regain" under the available range of temperature and humidity.

(10) A shrinkage determination should be made.

Wing and Dope Varnish—Dope alone on Irish linen surfaces has proved very satisfactory. Four to five coats, allowing about one-half hour for drying between each coat, are ample protection for the most severe conditions. Varnish finish is recommended in many cases as more permanent and, being less affected by salt water, has some advantages on water machines. When repairing is to be done, it is first necessary to remove the varnish before the patch is applied with dope, as a glue, causing some inconvenience. Doped surfaces have about 8 per cent to 10 per cent more strength and more resistance to tearing. It is necessary to redope all surfaces every three to five months. Cotton and silk fabrics have a tendency to rot when covered with dope or varnish and such surfaces are not recommended.

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The main requirements of an airplane engine are light weight, low fuel and oil consumption, reliability, accessibility, and a form suitable for installation in an airplane. Selecting an engine for an airplane means unfortunately buying the engine most nearly suitable which is purchasable at the moment, and the choice is none too great. As regards reliability, no rules can be laid down. Satisfactory tests in Government or college laboratories are good guides. The

reputation which an engine has earned among pilots under the more trying conditions of actual flying is even more important. Accessibility depends not only on the design of the engine itself, but on its careful mounting in the body. Fuel and oil consumption, weight and suitability of form are best studied by the compilation of a table (such a table included in the article). The form of an engine, from the point of view of mounting and projected area, are best studied from drawings appearing in technical magazines and makers' catalogs. The question of revolutions per minute, apart from the question of power and efficiency in the engine itself, has an important bearing on propeller design. Wooden propellers of large diameter seem to reach their maximum permissible safe speed at about 1300 r.p.m.

On a school Curtiss of the *JN* type with a 90 hp. Curtiss engine, the figures for a Rome-Turney radiator are:

Weight of empty radiators..........	58½ lb.
Weight of water contents	24¾ lb.
Thickness of core	2⅞ in.
Active front area................	400 sq. in.
Total radiating surface.........	15,360 sq. in.

From Dr. Hunsaker's experiments at the Massachusetts Institute of Technology, and certain theoretical considerations, a surface of .83 sq. ft. per bhp. has been found necessary for the honeycomb type. Tests at the Massachusetts Institute of Technology show that the resistance of a radiator may be represented by the equation:

$$R = X_x A V^n$$

where R = resistance in pounds,
A = area of radiator face in square feet,
V = speed in miles per hour,
and $K_x = .00175$

If a radiator is placed behind the propeller where the slip stream increases the velocity by some 25 per cent, the cooling surface may be decreased by 25 per cent, with a consequent reduction of resistance producing area, but since the resistance varies as the square of the velocity, there is finally an increase of 25 per cent. As to the construction of radiators, we may say that the simpler the outline the more durable will be the radiator—and the cheaper. As for water connections between engine to radiator and pump to radiator, it is very important that they be large enough to convey the large bulk of water with the least possible pressure. As to support of a radiator, the most satisfactory method is the use of a cradle or cross-piece at the front of the body, in the case of a tractor, on which the radiator is placed and fastened by studs in the bottom tank. As a general rule, the sub-division of a radiator into a number of sections is advantageous. In the present ill-defined position of radiator design, it is an advantage to be able to increase or diminish the radiator surface of a given machine.

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Worst Dynamic Loads; Factors of Safety—One of the most difficult problems in aeronautics is the estimate of the worst loads likely to come on under unusual circumstances, on which alone correct allowances for factors of safety can be based. Heavy loads come on an airplane under so many conditions, that the following classification is probably incomplete:

(A) In the air:
- (1) in flattening out of a steep dive
- (2) in heavy banking
- (3) in looping
- (4) in sudden gusts.

(B) On the ground:
- (1) on landing.

The wing structure will meet with the greatest loads in the air. The body may carry severe stresses in the air when powerful forces come into play on the rudder and elevator, but it may also be powerfully stressed on landing.

(1) *Flattening Out After a Steep Dive*—The exact mathematical computation of stresses in such a case is not yet possible. In the U. S. Army Specifications 1002, one of the stipulations for airworthiness is that the pilot may be required to dive at an angle of 50 deg. to the horizontal, to maintain such a dive for one or two seconds, and then to pull out reasonably quickly. If we assume the pilot can change his angle of incidence to say 8 deg. without losing speed, the lift of the machine becomes 14,400 lbs., or a load of nine times the weight of the machine. It is commonly accepted that the actual load is not quite so great, being between 5 and 6. The pilot could not easily wreck a machine with moderately strong controls, and weights distributed far from the center of gravity giving a large moment of inertia. But with a light machine, with weights close to the center of gravity and a powerful elevator, reckless recovery would be highly dangerous.

(2) *Loading in Heavy Banking*—The loading on a steep bank is dependent on the speed, radius of turn, and angle of bank. The load on the machine in banking will increase with the centrifugal force to be overcome in addition to the weight, and is, therefore, greatest when the velocity has increased beyond the maximum in normal flight and when the radius of turn is very small.

(3) *Loading in Looping*—The probable maximum loading is estimated to be 4.

(4) *Stresses Due to Gusts*—Another cause of violent stresses is in the action of sudden guests on a machine, where the inertia tends to maintain the same speed for a different angle of incidence, or the same incidence for a different speed. The machine may encounter:

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(a) a head-on gust
(b) a following gust
(c) an up-gust
(d) a down-gust.

(a) *Head-on Gust*—Imagine the Clark machine to be moving at 59 m.p.h. at an angle of incidence 2 deg. against a head on wind of 20 m.p.h. so that its absolute velocity relative to the earth is 39 m.p.h. If the head-on wind increases to 30 m.p.h., the absolute velocity relative to the earth will still remain at 39 miles for a second or two. During this period, the velocity to the air will increase to 69 miles per hour, with the angle of incidence unchanged. There will be an acceleration upwards and an increased load on the machine $= 1.36\,W$.

(b) *Following Gusts*—If the machine were traveling in a following wind, which suddenly diminished, a similar action would ensue, since the relative velocity to the air would here also increase. If on the other hand, in the case considered above the head-on gust suddenly diminished to 10 miles an hour, the relative velocity to the air would be decreased to 49 miles per hour. The lift on the wings would, in this case, be actually less than in normal flight, so that the machine would drop.

(c) *Up-gusts;* (d) *Down-gusts*—With normal flying weather, the effect of gust should never increase the load to more than two or three times the weight of the machine.

Limiting Velocity for a Sheer Vertical Dive—A sheer vertical dive is only possible if the machine is at the angle to the vertical which gives no lift, and the elevator is set only at such an angle that the moment of the total drag about the center of gravity is neutralized. The limiting velocity $= 134$ m.p.h., which is not so very much greater than the limiting speed on the 50 deg. dive. The load on the landing gear is nearly 14 times the weight of the airplane, if a motion of only 5 in. is allowed. This requires an excessive factor of safety and makes a very heavy construction. Of course, no allowance has been made for the collapse of pneumatic tires, which may add 2 in. to the motion of the recoil mechanism.

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Preliminary Design of a Secondary Training Machine—Every designer will approach the design of a new machine in a different manner, and no definite rules can be laid down. Recalling Army Specification No. 1001 (detailed in Part 2, Section 1), we have to meet the following requirements:

Pilot and passenger, 330 lbs.
Gasoline and oil for 4 hours' flight.
Engine between 90 and 110 hp.
Maximum speed, 75 m.p.h.
Minimum speed, 43 m.p.h.
Climbing speed, 3000 ft. in 10 min.
Two wheel landing gear.

We shall select the Curtiss 90 hp. *OX*. Practice shows that the above performances can be achieved with a weight of about 1850 lbs., *i. e.,* 20.4 lbs. per horsepower, and we shall make this our preliminary estimate.

The first step is to set down all weights of which we can be fairly certain, and on which no improvement is possible, thus:

		lb.
AB	Pilot and passenger in aviation dress	330
C	Engine and accessories	360
D	Radiator	50
E	Water in engine and radiator and piping	40
F	Propeller and hub	35
G	Gasoline tank of 40 gallons capacity	30
H	Gasoline and oil for 4 hours' flight	220
IJ	2 Instrument boards, with a set of barograph, tachometer, air-speed indicator and clock on each	40
KL	2 Dep controls	25
		1130

This leaves us with some 720 lb. available for the purely structural parts of the machine: chassis, complete body assembly, wings, interplane bracing, and tail surfaces. For a machine of this type it is not necessary to have a wing of extreme characteristics. It is more practical to select a good all-round wing, with fair structural characteristics, than to choose a wing with high efficiency at low speeds, but a low lift coefficient at maximum angles, and the R.A.F. 6 can be adopted without much chance of mishap. On this particular machine we shall employ a very slight stagger of about 5 per cent, giving a good overhead view for the pilot. Overhang is likely to improve efficiency, but no aerodynamical data are available. We must also settle on gap/chord ratio. We have seen in our aerodynamical work the improvement consequent on great gap/chord ratio. But to offset this, we have the question of increased weight and resistance of struts and wires. Since at high angles the tail surfaces will also be providing some lift, we may safely use this figure. The questions of aspect ratio is again only partially dependent on efficiency, and a large aspect ratio introduces structural difficulties and tends to lateral instability. We shall assume an aspect ratio of 7 to 1 on both planes. If $x =$ chord in feet, $7x =$ span, and we have $14x^2 = 376$ and chord $= 5$ ft. 2 in. and span $= 36$ ft. 5 in. The designer is always tempted to shorten the length of the machine and to rely on a large stabilizer placed at a big negative angle, to secure static longitudinal stability. But in dynamical stability it cannot be too strongly emphasized that damping is also essential, and damping improves rapidly with the length of the stabilizing arm. By empirical rules, such as outlined in Part 2, section 1, the control surfaces may be fixed approximately at:

Ailerons	35 sq. ft.
Elevator	22.0 sq. ft.

Horizontal stabilizer	*28	sq. ft.
Rudder	12.0	sq. ft.
Vertical fin	4	sq. ft.

* At an angle of 3 deg. to the wings.

In order to fix the position of the center of gravity, a vector diagram for the whole machine is necessary. The best that can be done in preliminary design is to make as shrewd a guess as possible, and to draw comparisons from as many model tests as possible. (Fig. 1 shows a side view of machine, with the vector diagram of a wind tunnel test.) The center of gravity is indicated in the sketch, and lies on the 4 deg. vector. Such an arrangement will give an adequate amount of longitudinal static stability. The propeller thrust passes thru the center of gravity and does not, therefore, affect the stability in normal flight. The next step is to see whether we can balance our machine about this point both in a vertical and in a horizontal plane. We shall employ the usual method for finding the center of gravity of a system consisting of a number of small bodies. Dividing the moment by the total weight of the machine, we see that the center of gravity of the machine is 6.53 ft. back of the moment axis. This brings it to a position virtually coincident with the tanks, and about one-third of the chord from the leading edges of the wings, which is virtually the position chosen from the vector diagram.

[Course in Aerodynamics and Airplane Design. By Alexander Klemin, A.C.G.I., B.S., S.M., and T. H. Huff, S.B., Instructors in Aeronautics, Mass. Institute of Technology. *Aviation*, June 1, '17. 3700 words. Illustrated.]

The design of landing gears is among the most complex of the problems which confront the aeronautical engineer, due to the many conflicting factors which must be taken into consideration and, so far as possible, reconciled. The height of the chassis is dictated by the necessity of providing ground clearance for the propeller and by the angle of attack which is desired in starting and in pulling up after touching the ground. The track must be sufficient to insure against overturning when making a landing on rough ground, yet not so great that the striking of a soft spot by one wheel will give rise to an excessive amount tending to spin the machine around. The fore-and-aft location of the wheels is determined by the requirements of longitudinal stability on landing. The structure must be strong enough to withstand side thrusts and twisting moments due to alighting on one wheel, as well as the large direct dynamic stresses which are set up when an airplane lands without sufficient flattening out of the angle of descent. Lastly, the means of shock absorption must be of such quality and number that they will permit of high speed along the ground and of heavy landings, without breakage of the shock absorption means itself and without danger of the "bottoming" of the axle in its guides.

Chassis Height—With a conventional shock absorber, allowing a total displacement of five or six inches, the propeller clearance with the machine stationary should be not less than twelve inches, thereby insuring a minimum clearance of six inches when the shock absorber has its maximum displacement. The tread, or track, is, on airplanes of conventional size, from 5 to 7 ft., except on slow pusher biplanes with long skids, where it may reach values as high as 13 ft. An unequal distribution of stress between the wheels, due to landing on one wheel before the other, or to a difference in ground conditions between the two tracks, produces a moment tending to twist the axle about a vertical axis. This moment is carried to the struts or skids by means of axle guides or radius rods, and thence to the body. In order to resist side blows, too, a special wheel construction is necessary, as an ordinary wire wheel, such as is used on motorcycles, will be completely wrecked by a relatively small side blow against the rim. It may be laid down as a rule that the length of hub should be at least twice the diameter of the tire, and three times is preferable. Rubber and steel springs are the only substances which have been widely used as shock absorbers. Of these, rubber has proved by far the more satisfactory, due to its easy fabrication and replacement, its greater energy-storing capacity (500 to 1000 ft. lbs. per lb., as against 10 to 20 ft. lbs. per lb. for steel), and, most of all, the fact that it actually absorbs and dissipates the energy instead of storing it and giving it out again. Where helical springs are used, as on many large pusher biplanes with four-wheeled landing gears, they are usually in combination with a hydraulic or pneumatic shock absorber. In order to provide the desired shock absorption capacity, machines of the size which we are considering use 26 x 4 or 26 x 5 wheels. These wheels weigh, complete with tire, from 17 to 25 lbs. each, and the manufacturers recommend that they be pumped to 60 lb. pressure. We may, in general, divide chassis into three classes: self-contained chassis with wheels alone, chassis with two principal wheels and a tail skid, and chassis built up around one or two long skids as a basis. Chassis with wheels alone were first used by Curtiss. Due to their complexity and considerable weight and resistance, they are now seldom employed except on heavy machines, particularly pusher biplanes designed for gun-carrying, where they are generally combined with helical steel springs and hydraulic shock absorbers. Chassis with two principal wheels and a tail skid, either with or without one or two subsidiary, and usually unsprung, wheels in front, are nearly universally employed on machines of medium and light weight, except on the very slow and lightly loaded pusher biplanes. The framework of such a landing gear is reduced to its lowest terms, consisting, in its conventional form, merely of two V's, closed at the top by the lower body longerons, and separated at the top by a distance equal to the width of the body, and at their lower vertices by a little less than the track of the wheels. On speed scouts, where the reduction of resistance is of the utmost importance, the chassis is sometimes so built that it forms a unit with the wings. This makes possible the elimination of all wiring from the chassis, and in a few cases from the wing panel as well.

AERONAUTICS—Continued

Chassis based on long skids are used on Farman, Caudron, and Wright biplanes.

Among the hybrid types, involving some of the features of all three chassis, one of the most interesting is the old Nieuport. In this there were 2 pairs of struts, each forming a V with the vertex downward. At the bottom of these was mounted a comparatively short skid. Below the skid a leaf spring, of semi-elliptic form, was clamped, and the wheels were at the extremities of this spring. The rear of the skid acted as a tail skid, and, in addition, made a very effective brake, as it was close to the c.g., and consequently carried a considerable portion of the weight. The best example of a brake depending on air resistance is the airplane itself. It has often been proposed that air brakes, consisting of surfaces normally lying parallel to the line of flight, but capable of being pulled around approximately normal to that line, should be provided. If two such surfaces, one on either side of the body and at a considerable distance from the longitudinal axis, are furnished, one at a time may be pulled out to act as a drag and assist in turning the machine in a small circle while taxi-ing, or both may be used at once as a brake. Brakes depending either directly or indirectly on friction, with the ground for their retarding power, may be subdivided into wheel brakes and sprag or claw brakes. Claw brakes are more used than any other type. They are usually attached to the strut, which lies just below the axle in a V-type landing gear, and are hinged to that strut. The claw on the end can be brought to bear against the ground by a lever within reach of the pilot. The advantage of such a brake is that, being in back of the forward point of suspension, the claw tends to release itself as the machine starts to dive, pivoting about the point of contact of the wheels with the ground. It is of interest to determine the retarding force required to bring a machine to rest in a given distance. If, for example, we wish to land a 2500-lb. machine at 45 m.p.h. and bring it to rest in 200 ft. after touching the ground, we have $s = \frac{v^2}{2a}$ or $a = \frac{(66)^2}{600} = 726$ ft. per sec. in which a is the necessary deceleration. F, the average retarding force, $= \frac{Wa}{g} = 565$ lbs., a force which might easly be secured without the use of any brake save that afforded by the wings themselves.

[Course in Aerodynamics and Airplane Design. By Alexander Klemin, A.C.G.I., B.Sc., S.M. and T. H. Huff, S.B. *Aviation*, June 15, '17. 2800 words. Illustrated.]

In the Fig. are shown three views of a secondary training machine, very similar to the JN-2, and in accordance with our figures of Section 7.

A few modifications have been made in the process of drawing up the machine from the figures given in Section 7. The rudder has been reduced in area from 12 to 10 sq. ft., and the vertical fin from 4 to 3.5 sq. ft.

The stabilizer and elevator have been left unchanged. In drawing the plan view of the machine, modifications were also found necessary in the ailerons. The original scheme was to place the ailerons on the top plane only. The better plan seemed to be to place the ailerons on both surfaces. Their area was also slightly increased from 38 to 42 sq. ft. total area.

It must be insisted upon again that this machine is not a perfect specimen of its type. For instance, had an overhang been employed as on the JN-4, the aileron area of 35 sq. ft. with its greater lever arm, would have been amply sufficient. Also the outer strut would have been almost at the mid point of the aileron, thus permitting the use of a single aileron post; whereas in the present case we are obliged to use two aileron posts.

Another poor point is that the tail skid abuts directly on the rudder post. The control surfaces should never be so placed as to sustain injury by an abrupt landing, as might be the case in this arrangement.

The power plant and personnel must be enclosed in a form approximately streamlined. The general shape of the body is largely determined by the size and shape of the engine selected. For the vertical six-cylinder engine, a wider but shallower body is advisable, and with a rotary engine a body of very large maximum diameter.

A flat bottomed body may be very helpful in securing longitudinal dynamic stability. A body with flat sides has to be handled carefully. One of the reasons why totally enclosed bodies have not come into use is that with their large fin areas, they have a tendency to spinning.

Apart from the necessary length of body to give sufficient arm to the tail surfaces, it is important that the tail surfaces be far enough away from the wing so that the wash of the wings should not affect them too much. To protect the face of the passenger, a transparent lip is generally fitted on the front edge to deflect the air upwards.

Engine Installation

Should be readily accessible and cowling easily removable.

Gasoline Tanks

Should be near the center of gravity of the whole machine, so as to disturb balance as little as possible as fuel is consumed.

Engine Foundation

Must be rugged to prevent loosening up of the bolts by vibration, transmission of the torque of the engine to the body, and breaking loose in a bad landing. Nevertheless, the foundation should be flexible enough so that the slight engine vibration is easily taken up.

Engine Must Be Secured Against Weaving

When the airplane pitches, there is a tendency owing to gyroscopic action of the propeller, for the engine to "weave" either to right or left.

Strength of Body

The body must be strong enough to withstand (a) air loads due to tail surfaces, (b) dynamic loads in the air, (c) loads on landing.

By careful selection of spruce the crippling loads given by the above formulas can be easily secured. It was formerly customary to use a material factor of safety of 2 for the wing struts, and 1½ for body struts. It is usually assumed that

(1) wing struts with pin joint fastenings are hinged at either end;

(2) winged struts with socket fastenings of usual type are considered as being fixed at one end, and round at the other;

(3) body longitudinals, continuous over joints, are taken as fixed at ends;

(4) body horizontal and upright struts are taken as fixed at one end and hinged at the other.

Body stress diagrams are still on a somewhat unsatisfactory basis, and a number of different methods are adopted. Altho the longerons of a body are continuous, and the cross bracing members more or less fixed, stress diagrams are always drawn as if it were entirely a pin-jointed structure.

Army Specifications 1000, 1001 *and* 1002

Factor of safety not less than 2.5. This is based on the forces met with when the machine is violently righted after a rapid dive. It takes care solely of the air loads due to tail surfaces. When in the air the body is supported at the hinges of the wings, and the air loads are not transmitted to the part of the body forward of the hinge pins. It can be seen that this is by no means an ideal specification.

Army Specification 1003

Body forward of the cockpit shall be designed for a factor of safety of ten (10) over static loading conditions with the propeller axis horizontal.

This specification is sounder than the previous one. It imposes the air load on the rear part of the body, which is as it should be, and provides a sufficient dynamic loading for the forward part of the machine.

Another Suggested Method

In the authors' opinion, the stress diagrams should be even more complete. They should include calculations (a) carried thru on the air loads, (b) calculations carried thru on the landing loads, specifying some landing speed, a gliding angle, and travel of shock absorber.

—Transport by

[The Safe and Useful Airplane. By Orville Wright. *Aviation,* Apr 1, '17. 4333 words. Illustrated.]

It is my conviction that, had the European governments foreseen the part which the airplane was to play, especially in reducing all their strategical plans to a devastating deadlock, they would never have entered upon the war. When I was in England several years ago, I found the British Government not at all enthusiastic about the airplane, since the English military experts regarded it as a menace to England's isolation. Most of us saw its use for scouting purposes, but few foresaw that it would usher in an entirely new form of warfare. As a result of its activities every opposing general knows precisely the strength of his enemy and precisely what he is going to do. Thus surprise attacks, which for thousands of years have determined the event of wars, are no longer possible, and thus all future wars, between forces which stand anywhere near an equality, will settle down to tedious deadlocks. My main interest is in the airplane as a real promotor of civilization. Recent events have made us regard it almost exclusively as a weapon of war. After the war we are told we shall have a new world and a new type of civilization; in my opinion one of the factors that will contribute to this changed order will be the part which will be played in it by the airplane. We shall have an entirely new form of transportation, which will serve many ends and contribute in many ways to the welfare and happiness of mankind.

The airplane will not supplant the railroad, the trolley-car, or the automobile. We shall have no airplanes as large as the *Lusitania.* The airplane is built essentially upon the same principles as a bird; it has the same flying capabilities as a bird, and precisely the same limitations. The best flyer among birds is the humming-bird. The airplane is a method of transportation that works best and least expensively in small units. We can get better and cheaper service out of two airplanes of moderate size than we can get out of one which is twice as large. The average citizen is still frightened at the prospect of leaving the ground and having no support except the air itself. Yet at the speed which we expect an airplane to maintain—seventy or eighty miles an hour—there is no means of transportation that is so safe. The obstructions that cause accidents with trains and automobiles do not exist for flying craft. Certain performers have done much to instill this notion that flying is exceedingly dangerous. These are the daredevil exhibition flyers, who cultivate the circus aspects of the art. Both by words and deeds they have associated the airplane with the idea of danger. They have had many bad accidents, too, which have been the necessary consequences of inexperience and of taking foolish chances. The man who first looped-the-loop made a solid contribution to the cause of aeronautics, for he demonstrated the wonderful stability and righting power of the airplane. What other means of transportation, except the airplane, sails just as well upside down? If one has a wide, smooth, open place for his descent, all is well; but it is inconvenient and it may be fatal to land in the top of a tree or somewhere in the neighborhood of a sky-scraper. Of actual upsetting in the air — that is, a genuine fall, such as was not infrequent in the early days — there is now very little danger, and there is no reason why accidents of this kind should ever take place, for, as I have already said, an airplane, no matter what position it gets into, is easily righted. We also hear much about the stopping of the engine. The public has the impression that this dead engine is one of the greatest perils of flying. As a matter of fact, the stopping of the engine is not necessarily a serious matter. The engine does not make the airplane fly—it merely propels it. The machine flies when the engine stops, only

AERONAUTICS—Continued

it does not fly on the horizontal plane. Whenever this happens, it glides easily and gracefully toward the earth. A height of two thousand feet, giving a gliding range of three miles, is usually safe for all purposes, as, from this height, the flier can discover a level spot within that large radius. Few express trains average more than fifty miles an hour—tho they make greater speed on short stretches of straight track—whereas that speed represents almost the minimum of the flying-machine. We think nothing of sixty and seventy miles, a regulation speed of one hundred miles may be expected, and, as said above, certain pursuit airplanes now used in the war go at the rate of one hundred and twenty-five miles an hour. On a railroad car we are always conscious of high speed; well up in the air we are not conscious of it at all. The trip from New York to Boston would take about two hours, where it now takes five. From New York to Chicago will take eight or ten hours instead of twenty, as at present. The present type of machine will never supplant the freight-car, and I cannot foresee that it will ever be used for carrying coal or wheat. But in transportation of special small packages, precious freight, it will be extremely useful.

There is a certain port in Alaska back of which, about sixteen miles away, lie rich gold-fields. The problem of the company which works these mines is to get supplies to its men and to get the concentrate back to tide-water. The company is now completing plans to install an airplane service. In this way the workmen can easily sail over the mountainous barriers and reach the miners in an hour. In Mexico we have had an example of the use of the airplane for carrying mails. Practically all the mails from Columbus, New Mexico, to Pershing's column have been carried by air. The time is not far distant when people will take their Sunday afternoon spins in their airplanes precisely as they do now in their automobiles. Winds no longer terrorize the aviator. Newspaper readers will remember that, ten years ago, my brother and I carefully selected the days in which we made our flights. But we have learned now how to fly, and even strong gales do not now frighten the fliers.

[The Dawn of the Age of Commercial Aerial Transportation. By Henry Woodhouse. *Flying,* Oct, '17. 2060 words, illustrated.]

The expenditure of hundreds of millions on airplanes and aeronautic motors, and the exigencies of the war have developed aeronautics to the point where it is possible to think in terms of commercial transportation. Capt. Laurenti on Aug. 29, established a new world's long distance record when he flew from Turin to Naples and return, a distance of 920 miles, without stopping. On Sept 24, he flew from Turin, Italy, to London without a stop. He left Turin at 8:28 A. M., Italian time, and landed at Hounslow at 2:50 in the afternoon, having completed a journey of 656 miles in 7 hours and 22 minutes. Thruout the journey he kept an average altitude of 9900 feet. During the trip he took food from a bottle fastened inside his coat and fitted with a rubber tube like an infant's feeding bottle. A look at the Italian machines flown from Langley field during the past two weeks, shows that we are now building airplanes for commercial purposes. Among the reports collected by the Aero Club of America there is one in which are found the following provisions for the use of aircraft: (a) Transit of goods. (b) Transit of letters. (c) Transit of persons. (d) Private, domestic and sporting purposes. (e) Scientific uses, surveys, etc. Aeronautics is to be the most important factor in the reconstruction that will follow this war, just as it is the most important factor in the present war and will decide the war in the air. Italy and France both make use of airplanes no longer suitable for military use for the purpose of delivering mail. Italy has an aerial mail route from her coast to Sardinia, and is able to deliver 500 lbs. of mail in two hours. France has a similar aerial route between her coast and Corsica.

[Atlantic to Be Crossed Within Few Months and Difficult Problem of Delivering Aeroplanes to Europe Solved. By A. R. Hawley, Pres. Aero Club of America. *Flying,* Oct, '17. 1860 words. Illustrated.]

The Atlantic is to be crossed within a very few months and the difficult problem of delivering to Europe the airplanes needed for striking Germany thru the air will be solved thereby. With that flight will start the era of commercial aerial transportation. All the factors necessary for crossing the Atlantic by airplane are available. There only remains to try the first flight. The distance between Newfoundland and the Azores is less than 1200 miles and those who have given thoro consideration to the subject have had little doubt for the past seven years that an airplane could be built that could cover the distance. With the progress that has taken place in developing radio direction finders it would be possible to equip a trans-Atlantic flier with such a device that would always point to the direction of the sending station, so that if any station was established at the Azores the aviator would have no trouble. We have been assured that an instrument can be obtained weighing less than 100 lbs., and having a radius of close to 1500 miles. The largest Caproni triplane can make the trans-Atlantic flight easily and the Caproni Company will be glad to undertake it if arrangements can be made for it. Italy built these huge machines for her operations against the Austrians over the mountains and the Adriatic Sea. They have all the requirements necessary for major operations against the German U-boat and military bases. The Curtiss Co., the Gallaudet Co., and the Handley-Page Co. are ready to produce trans-Atlantic fliers. To carry out the plan with one machine may cost $100,000. To do it with several machines with patrol ships along the route may cost $1,000,000. The flight is really simple when compared with some of the operations that have had to be conducted in the present war, such as those that resulted in the mining and blowing up of Messines Ridge. If the machines were ordered

right away, the flight could probably be made between now and early Spring, and arrangements made to produce thousands of these machines and deliver them by air next Summer. The life of these large machines has been estimated at a minimum of 150 hours in the air, after which they must be overhauled. The flight across the Atlantic, together with the preliminary flights, would take about 40 hours of the airplane's life. That would leave 110 hours with which to conduct major operations against the German bases. As the distance between Great Britain and the Kiel Canal, where the German fleet is, is about 425 miles, and these giant airplanes go at a speed of about 90 miles an hour, there would be an expenditure of about 10 hours of flight in each raid. Therefore, the airplanes would last for about eleven raids after making the flight across the Atlantic.

—Transport of Aircraft—By Motor

[Special Type of Trucks for Signal Corps. *Commercial Vehicle,* Oct. 1, '17. 400 words.]

The Signal Corps will have two sizes of trucks, one light and the other a 3-ton truck, furnished in the ratio of two light to one heavy.

Specifications for the heavy trucks are now being drafted. The specifications for the light truck have been completed. Practically every one of the light trucks will have a two-wheel trailer with a body of light construction, 20 feet long, this being large enough to contain the best part of a whole airplane of usual size.

A squadron will have about 27 trucks, two-thirds at least being of the light model, and one of the large trucks will be a repair shop. This shop will be a self-moving unit, not having lathes and tools on a trailer, owing to the need for taking repair facilities to distant places with rapidity.

—Types

[The Latest Airplanes. By G. George Prade. (From the London *Times* of April 7, '16.) *La Guerra y su Preparación,* June, '16. 3000 words.]

The experience gained in twenty months of warfare has disposed of the idea that unity of type is possible.

On the contrary, it is important to establish special types of airplanes for different purposes. It is clear today that the airplane can be applied to all sorts of purposes.

Four principal classes are now recognized, according to the most important application for which intended: (1) scouts; (2) artillery planes; (3) bombing planes; (4) combat planes.

Scouts.—These are used to reconnoiter the enemy first by direct observation, and next by photography. At the beginning of the war these planes called for a great radius of action, reduced since by the general resort to trench warfare. It is necessary therefore that they should carry great quantities of gasoline. Other principal qualities are high maneuvering power, climbing power, and ability to escape pursuing planes, since it is almost impossible for combat planes to accompany the scouts. Their equipment should consist of a special camera, a machine gun able to fire in all directions, and finally a wireless set, of special utility in reporting the advance of troops in important battles. The characteristics of the scout are less well defined than those of any other type. It must satisfy a great number of conditions no one of which is more important than the rest, except the power to start and land with great ease on no matter what ground. As types of this class, biplanes of forty-three feet spread, with motors varying from 80-150 h.p. have been adopted.

Artillery Planes.—The ideal apparatus for the observation and adjustment of artillery fire would be a kite that could rise and descend at will and remain motionless over the target. The artillery planes should be able to fly slowly and should allow the observer to see in all directions, because on this duty photography cannot take the place of direct observation. The observer must be able to see the fall of each projectile, and, by means of wireless, to correct the fire of the battery. At the same time he must be able to escape the fire of the hostile artillery and the attack of pursuing planes; this attack is easy because the observing plane is required to accomplish its mission and remain over a determined sector known to the enemy. The apparatus must be consequently light, small, able to climb rapidly, stable in any wind and affording the observer complete liberty in fulfilling his mission. Hence are employed small biplanes of thirty foot spread, driven by a pair of powerful rotary motors. The seat of the observer must be lightly protected, but it is not necessary to exaggerate this protection and thus uselessly overload the machine. The artillery observer neither may nor should be concerned with hostile attack, because the mission on which he has been sent is enough to absorb his entire attention. It is his business to pass slowly and continually over the target observed. Besides, as his itinerary is perfectly well known, nothing is easier than to protect him with a pursuing plane flying above him and so dominating in advance this altitude against hostile planes that may come to the attack.

Bombing Planes.—This plane is the dreadnought of the air. However, we should not allow ourselves to be deceived by the apparent facility with which the dimensions of this plane may be increased. A point is reached at which practical application diminishes with the increase of the power of these planes. It is better to distribute a great weight of projectiles among a greater number of machines, because in this way we obtain greater security, greater accuracy and gréater facility in launching bombs in a smaller time. Probability of escape is also greater. The bombing plane must have a minimum of velocity, maneuvering facility and climbing power which will enable it to escape the fire of anti-aircraft artillery. And so far as planes of pursuit are concerned, we cannot expect that bombing planes should have to defend themselves against them. The bombing planes should be escorted by squadrons charged with this mission alone, and composed of machines in which the weight carried consists of bombs, guns and ammunition. Bomb squadrons are composed of various units operating over

AERONAUTICS—Continued

known itineraries and in a fixed number of hours. Escort duty consequently is easy. It has been found possible to keep as many as fifty machines flying in a triangle like that of a flock of ducks. These have been able to fly as far as Stuttgart, Karlsruhe and Mannheim. This class of machine therefore calls for powerful motors, 200 h.p., great radius of action, length of fuselage to permit good aim in the discharge of bombs, which are let go by means of special apparatus assuring their fall at the desired point. They must also carry machine guns. It is the most difficult apparatus to build and the mission of its pilot is as dangerous as it is difficult.

Combat Planes.—These machines are the last word of military aviation. In air combat, the first condition is to take advantage of one's own planes and prevent the enemy from doing the same with his. Thus has arisen the chasing airplane, a light apparatus of great climbing power in order to get above its adversary, the most important advantage of all in the struggle of the air. Finally we have the destroyer, intended to defend scouts, observers and bombing planes against the pursuing machines of the enemy. These destroyers are of the same type as the pursuit planes, but are more heavily armed. Combat planes cannot be of great dimensions. This condition limits their armament and equipment. Most of them do not weigh more than one ton. They are the only machine equipped with a single seat. The pilot is at the same time the gunner.

In respect of the position of the propeller there are two schools: first, those who advocate tractors, and those who advocate pushers. Tractors allow an increase of speed, but have the disadvantage of impeding fire ahead. Pushers give a smaller speed, but better fire. The tractors have won the day, since it is easier to employ methods of overcoming the necessity of firing thru the propeller than to do without speed, without which, of course, pursuit is impossible.

The bombing plane is the largest and most powerful of all flying machines; the smallest is the pursuing plane.

The superior and inferior limits of dimensions, from the point of view of construction, are imposed by the full consideration of the application of these two classes of apparatus. The airplane is too small when it cannot carry a machine gun. An airplane is too large when its increase in power and lifting surface ceases to increase proportionally with the weight it is able to transport. Moreover, it is impossible to exceed certain limits in the performance of the materials employed in construction. In general, a moment arrives when we cannot increase the dimensions of the apparatus, because we have reached the size when it is no longer able to support the pressure and resistance due to the increase of the mass. It is at this critical moment that one of two things occurs: either there is a reduction in the factor of safety, which is in general six, or the construction is modified and reenforced and the apparatus gains in weight; then it transports less useful weight. Moreover, piloting becomes difficult, because if the machine is too heavy, it does not readily answer to the maneuvering equipment. These are the reasons why no gigantic machines exist.

Airplanes will never practically exceed certain dimensions, at least as long as flight is regulated by the same laws [as at present], and as long as the actual relation between motor and weight remains unaltered.

[Military Aeroplanes. *Aviation,* Sept 15, '16. 2280 words.]

At a recent meeting of the aeronautical motor division of the Society of Automobile Engineers, the question came up as to just what size of motors would be needed for the future military machines. The present two-place machines used in our service, with the pilot in rear and the observer in front would be at the mercy of any attacking aeroplane. The pursuit type of machine has tremendous speed and climbing ability and is most easily controlled. By its quick changes of direction it makes a very small and bewildering target. The design of such a machine for use in the U. S. would follow closely the features embodied in the Fokker, Nieuport, Vickers, Bristol and Sopwith. All of these machines use very light motors of from 80 to 150 h.p.

The second type carries a military load of about 475 lbs. fuel for five hours, and has a slow speed of about 45 miles per hour. Its gross weight is about 2400 lbs. By sacrificing speed range and climb we can carry 900 to 1000 lbs. military load, at least half of which may be bombs and fuel for 5 hours. By assuming a load of about 19 pounds per h.p. we find a motor of 260 h.p. will be sufficient. The radius of action of such a machine will be about 400 miles at full power or 550 miles if flown with the motor throttled. This power can be obtained from one or two units. At the present time, due to the fact that there are no thoroly developed motors of over 200 h.p., it is necessary to use two motors of 130 h.p. each, probably 6 cylinder vertical type. In the twin-motor type, the pilot can be seated in the rear cockpit in rear of the propellers, the observers in the forward cockpit in front of the propellers, with the bombs and gasoline between the two over the center of gravity. By installing a machine gun in the rear cockpit and an automatic stabilizer, the pilot can fight a machine, in rear, to either side or above. By reducing the weight of bombs to one each of 50 and 75 pounds an ideal long range, strategical machine is obtained by using the weight-carrying ability gained for carrying gasoline. Now, by making slight changes in the construction, a third man can be placed over the center of gravity with the controls, and the front and rear man can devote all of their attention to fighting. By doing away with the third man or bombs and replacing the wheels with floats a military hydroaeroplane is obtained. It is believed that the development of the above standard twin-motored machine is a problem demanding immediate attention.

—Use of in European War

See also

GRENADES (Article: "'Marines Manual' Department")

LA FAYETTE FLYING CORPS

[Aviation in the French Army. Reports by Observers in France, Col. Echagüe and Lieut.-Col. Garcia Benitz. *La Guerra y su Preparación*, Sept, '16. Drawings. 2000 words.]

I.—Organization and Use of Aeroplanes

The so-called fifth arm is developing and becoming more active each day in the French army. It appears that the squadron is now established as a tactical unit, commanded by a captain pilot and similar in organization to the company, troop or battery.

The squadrons are at the disposal of the commanding general of the army, who distributes them according to the needs of the service. In rear of the line there is a series of supply stations consisting of the army aviation park with repair shop, and a reserve supply of spare parts. Further back, reserve centers are situated at different points in the so-called interior zone.

There are also a number of schools of instruction, the principal one being that established at Buc. The whole service is directed by the Bureau of Aviation in the War Department. A brigadier-general is in charge of this bureau.

The squadrons are of three kinds: reconnoitering (for seeking out the positions of enemy troops and batteries, correcting artillery fire, signalling targets, etc.), bombarding (for bombarding cities and hostile establishments); and the so-called chasing squadrons, which are used as a sort of aerial police, to fight off hostile airships and support the bombarding squadrons, which, in important operations form the superior unit.

It has been shown by experience in the war that the aeroplanes should be two-seated, so that the pilot may always be accompanied by an observer or a gunner. Exceptions to the rule have, however, been made, as in the case of Gilbert, Pegoud, Garroe and others, who have worked alone, managing both the plane and a machine gun with considerable success.

The types of machine adopted for the three different classes of service are at present:

Reconnoitering—Maurice Farman and Caudron biplane.

Bombarding—Voisin metallic biplane.

Chasing—Morane-Saulnier and Nieuport light biplanes and monoplanes.

The tendency is to increase the motor power and consequently the speed of all of these types. The government has ordered 800 motors to be made in France by the Hispano-Suiza factory, which has produced a model believed to be the lightest in existence considering the power it develops.

The number of pilots graduated from the schools is about one hundred a month. Out of each twenty applicants, about five are declared unfit. Of the remaining fifteen, the best five are assigned to the chasing squadrons, the next five to the bombarding service, and the five least apt to the reconnoitering units. The instruction in the schools has to be very hurried, and this has caused numerous accidents.

As to the production of machines, the government shops have been turning out 250 a month, and these added to those contracted for by the War Department made a total at the end of last March of 4000 airships in the French army.

At the front we have repeatedly seen reconnoitering aeroplanes, French as well as German, subjected to a most intense artillery fire. Once we counted as many as fifty shrapnel bursts under one of them, but we have never seen one brought down. It happens sometimes but not very frequently.

The aeroplanes usually fly at a height of about 2500 meters. At this height they can on clear days obtain very useful photographs of hostile troops and positions and can at the same time be fairly safe from fire, not so much thru lack of sufficient range of the guns as thru the difficulty of laying the piece accurately. When the hostile fire is becoming too accurate for comfort, the aviator's defense consists in descending rapidly. This is easier than ascending and is just as effective in causing the pause in the firing necessary for the calculations for the new laying of the piece. We have learned that the Germans have a piece for use against airships which has a range up to a height of 5000 meters.

Aviators claim that in good weather they can distinguish everything at a height of 2500 meters, but we have seen batteries which have been for many months in the same place, without taking any greater precaution than to throw a few branches over the pieces or to locate them under the trees.

We have also been surprised to notice that cantonments of huts for the troops and headquarters a few kilometers behind the lines, which could easily have been signalled by aeroplanes for destruction by the artillery, have remained intact. We have been told that this was the result of a desire to economize on shells, since to produce any useful result would require a long and costly bombardment.

All along the Belgian line and in the Artois, the service of reconnaissance, or rather of observation, is aided by captive balloons.

In Nancy, where squadrons of as many as one hundred and twenty machines have operated in a group, attempts have been made to diminish their visibility. They are trying painting the under surfaces in different tints of grayish blue, and the upper surfaces, visible from the air when parked on the ground, with daubs of green, yellow and blue.

II.—Projectiles Used by French Aviators

Arrows.—Various kinds of arrows have been tried, the one finally adopted being an arrow consisting of an iron cylinder one centimeter in diameter and fourteen centimeters long, with a very sharp point at the lower end and the upper two-thirds of its length grooved so that the cross section takes the form of a cross. This shape causes it to take and maintain a vertical position in its descent.

The arrows are contained in boxes suspended from the areoplane and are released by a trap underneath. Each box contains five hundred arrows and all are released at once, altho the motion of the machine thru the air causes them to scatter a great deal as they fall. They are dropped from an altitude of about 2000 meters, from which height their force of penetration is

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very great. They are used principally against masses of cavalry.

Bombs.—There are bombs of various shapes and sizes, but instead of using the modern models, which would be very expensive, the tendency is to take advantage of the supply of antiquated projectiles which is on hand. One of the models used consists of a cylinder of iron, charged with 40 kg. of melinite and having a percussion fuse.

To keep the projectile vertical in its descent there was at first used a parachute of strong cloth, attached to one end. This later was replaced by an iron shell, fitted to a square box which contained the projectile or was suspended from its end. The shell ended in four blades, which curved in the shape of a helix and gave a rotary motion to the projectile in its fall.

III.—Methods Used by the French Army to Differentiate between Their Own and Enemy Aeroplanes

In order that they may learn to tell the difference between French and enemy aeroplanes, the troops are instructed as to certain distinguishing points in the silhouettes of the German machines.

The monoplanes are easy to recognize by the shape of the planes.

The biplanes are recognized from below by their silhouettes and from the side by the acute angle which the planes make with each other.

The French aeroplanes are painted in distinguishing colors and carry a tricolored cockade under each wing. The Germans carry a black bar and in many cases the iron cross painted on the under surfaces of the planes.

IV.—Aeronautics on the Western Front

The French are now following the lead of the Germans in making use of captive balloons for observation. There are great numbers of them all along the line and they are today the chief aid to the heavy artillery. We have been informed that, at the beginning of their Verdun offensive, the Germans sent up one to every kilometer of front.

A definite zone is assigned to each balloon for observation and on account of this and the fact that they are stationary, very good results are obtained.

Artillery and squadrons of light aeroplanes are specially assigned to the task of defending these balloons from aerial attack. We have noticed that this defense constitutes the principal mission of the large aeroplanes called Fokkers, and this explains why they never go beyond the German lines, but limit themseleves to describing circles above the captive balloons at an altitude which would allow them to dominate any other aeroplane which might come to attack it.

Similar methods exist in the French army, and there are indications that efforts are being made to perfect them.

[Foreign News, France. *Aerial Age Weekly,* Oct 9, '16. 418 words.]

In order that attacking troops may advance with a minimum of loss the French artillery officers have figured out mathematically just what type of guns must be used and how many shells must be fired. The object is to have one shell for every square foot to clear wire entanglements. The destruction of defensive works and first line trenches is done by trench mortars of all sizes. Howitzers are used against the second and third line trenches. When this work of preparation is employed the attacking troops are safeguarded by a curtain of fire that is moved forward as the troops advance. Owing to the difficulty of the troops keeping to any schedule it was a hard task to keep the curtain at its proper distance. The best solution came with the aerial supremacy of the Allies. Each division is provided with a number of infantry aeroplanes which follow the advancing line closely and keep the artillery informed at all times as to the position of the troops and the curtain of fire. In the attack on the Somme the curtain moved steadily 200 to 300 yards in front of the advancing troops and their loss was reduced very materially.

[Progress in Aeronautics. By Major H. Bannerman-Phillips. *United Service Magazine,* Oct, '16. 3200 words.]

It is remarkable to compare the thousands of machines in the British air-service today and the fourscore aeroplanes with which they started the war in 1914, and to think how the then establishment of some 1300 officers, and other ranks, including mechanics, has now risen to a total of five figures. Whereas they estimated for the cost of material and upkeep in thousands of pounds in 1914, they now work out sums in millions for purchase of aircraft and stores, and the numbers of the superintending and clerical staff have risen proportionately, so that instead of the few rooms originally occupied by the Directors of Military Aeronautics at the War Office, it has been necessary to take over a huge hotel and covert it into offices, and reorganize the Directorate in order to provide adequate control for air organization, equipment of aircraft, contracts, works supervision and inspection of finished products. All over the country aerodrome-sites have had to be selected, buildings erected, training instructors and machines provided, with hosts of mechanics to look after them. These latter include wheelwrights, fitters, coppersmiths, and many other trades, and to get men from civil establishments and make these efficient in the work of trained air-mechanics was no small job, but they have done it somehow and laid broad and strong the foundations and some of the superstructure of a highly skilled and flourishing industry. As regards personnel, great difficulties in regard to recruiting and training of airmen have had to be overcome, not because they have had few applicants for appointment, but because not every man otherwise eligible as a soldier is fitted for the work, and even when they have selected their candidates, the necessary training is costly and comparatively slow; you cannot make any use of half-trained men as pilots and observers, and to send up an inefficient man to spot for guns would be wasteful and disastrous.

Lord Montagu ascribes the loss of the cruisers H.M.S. *Nottingham* and *Falmouth* to the necessity which is incumbent on English Admirals to use cruisers for

doing work which in the German Navy is done by Zeppelin airships. He maintains that the North Sea is patrolled by the German airships overhead in all its length and breadth. If he is correctly quoted, this is rather a sweeping statement, but one cannot deny that such rigid airships as the German Navy has at its disposal are bound to be exceedingly useful. Whether the loss of the two cruisers referred to was due to want of aircraft may or may not be true as a particular case, but it does not require deep knowledge of naval matters to be firmly convinced that without rigid airships capable of keeping station, making long distance, oversea reconnaissances, and remaining in the air for much longer periods than heavier-than-air machines, the English Navy is more or less handicapped by comparison with that of Germany, and must expose its valuable cruisers and their crews to far greater risks than would otherwise be the case.

Altho the Zeppelin has remained the most successful rigid airship because of its lattice-girder construction, it has a very faulty shape and it is improbable that the solution of the problem lies in this airship. Among the successful designs are first, the Schutte-Lanz: This presents a better shape from the point of view of air-resistance; the internal framework resembles two huge corkscrews one within the other, crossed in opposite spirals and joined to form the girders of a tubular cigar-shaped skeleton braced with wire and taking strains by tension and compression. The second design is the Wulfing dirigible, possessing special features combining to some extent the principles of both the rigid and semi-rigid type of airship. The design omits the stiff box, or lattice-girders, thus saving weight and securing practical rigidity by other means. The skeleton is built of a number of longitudinal tubes curved to give the desired shape, a stream-lined-cylindrical with sharp bow and stern, at each of which points the tubes fit into a circular metal plate with a hole in the center, thru which passes a steel rod. A steel wire cable, in length six feet less than the hull of the airship, connects these two rods. The outer envelope fits over the skeleton enclosing a number of gasholders. The two steel tubes at the base are omitted and elastic strands take their places, thus leaving the base flexible. Before the inflation of the gas-chambers, the wire cable is allowed to remain slack; but when inflated, the threaded rods are drawn thru the metal plates and screwed up, thus rendering the entire framework rigid, the tubes being braced together diagonally and circumferentially by wires. When the gas expands or contracts with change of temperature, or atmospheric pressure, the elastic strands at the bottom of the framework allow considerably for expansion without loss of gas. The very great advantage these types of airships would have over the Zeppelin is the saving of weight. Tho it is true that the lifting power of the rigid vessel increases out of proportion with the size, and the "Super-Zeppelins" may be great weight-carriers, they are bound to become more cumbersome to handle and more difficult to steer in a wind, and especially more liable to mishap when being taken out of and into their sheds.

It is interesting to note successful raids by large Russian aeroplanes of the Slyr-Murometz and Ilya-Murometz type in the Gulf of Riga against a German seaplane station last month, in the course of which four aeroplanes dropped a ton of explosives on the sheds, fought eight German seaplanes which rose to attack them, and in spite of an intense fire from anti-aircraft guns, retired safely with a "bag" of eight enemy seaplanes destroyed either in the air or on the ground. From what was known of these Russian seaplanes before the war, they were not fast tho very steady, but they have since been known to keep up their end in a fight when the odds were two to one.

[The Airplane in the War. Compiled from various sources. *Memorial de Artillería,* Nov, '16. 3300 words.]

(This article is a compilation of two articles, one which appeared in the *Revue des Deux Mondes,* the other which appeared in the *London Times* of April 7, 1916. The latter was published in the DIGEST for January, 1917, pages 7 and 8, and contains all of the important subject-matter of this article.)

[Aeronautical Notes. *Scientific American,* Dec 16, '16. 200 words.]

Le Journal from official reports sums up the results of French aviation work from July 1 to Sept 25, 1916, as follows:—German chaser planes brought down, July. 38; August, 46; September, 48—total, 132. Aeroplanes fallen within German lines, July, 13; August, 45; September, 38—total, 96. Kite balloons destroyed, July, 14; August, 8—total 22. Bombs dropped in territory occupied by the Germans, July, 804; August, 1035; September, 2061—total 3900. Of these, 1527 (July, 454; August, 309; September, 764) were dropped in German territory.

[Aeronautical Notes. *Scientific American,* Dec 16, '16. 100 words.]

Prince Rupprecht has recently stated that the German artillery and aerial services on the western front have been strengthened. The aviators are now able to hold their own, and this has given the artillery an advantage. It was previously much exposed to observation by the Allied air service.

[Progress in Aeronautics. By Major H. Bannerman-Phillips. *United Service Magazine,* Dec, '16. 3200 words.]

The two classes of airplanes which carry out the Allied raids behind the German front are bombing-airplanes and destroyers or battle-planes. The "chaser" or destroyer was originally produced by the Sopwith Company and cannot afford to have any additional weight in the shape of armor. However, its small size and 100 h.p. engine enable it to travel at a pace and height which makes it a very difficult target to the enemy on the ground, and it can easily take care of itself against the enemies in the air by its qualities and speed and its machine-gun. The bombing-airplane, with a load of explosive projectiles, is not so easily maneuvered, and tho it can protect itself to a certain

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extent against aerial attack, it must expose itself to the aim of the anti-aircraft gunners when it descends to drop its bombs. Two other types of machines which lay themselves open to these same risks are those used by artillery spotters and aerial photographers. Armor plating is essential over the vital parts of this type of machine, and yet it is impossible to carry a weight of steel sheeting sufficient to protect them against anything heavier than the ordinary rifle bullet, that protection being nickel steel or chrome steel of four millimeters in thickness. One can duplicate the wires which control the steering and elevating gear, thus giving a margin of safety in case one set is cut by a bullet. The armoring of the cock-pit and engine-hood is bound to give the occupants a certain amount of confidence, in that they feel they are not quite so vulnerable a target for the enemy's fire. Moreover, a machine may have its non-vital parts riddled with bullet holes and yet carry the occupants to safety behind their own lines, whereas damage to the engine or controls may cause it to come down in the enemy's lines, with loss of aviator and machine.

The wrecked Zeppelin airship *L-33* shows that the construction from the point of view of air resistance has been much improved as compared with former models. There were four gondolas, one a double one containing three Mercédès engines of 240 h.p. each, while the other three gondolas each contained one similar engine. They worked six propellers, and a fuel supply of 2000 gallons of petrol could be carried in the tanks. The length was estimated at from 640 to 680 feet, main diameter 72 feet, gas capacity 2,000,000 cubic feet, and the total weight with officers, crew, and stores about 50 tons. The girder-work is extraordinarily light. It is supposed to have taken a year to build and cost about $1,750,000.

The material of the girder work is aluminum in appearance and probably an alloy of that metal. The skeleton is a stream-lined polygonal cylinder, with a blunt nose and sharply pointed tail, and is built mainly of longitudinal lattice girders held in position by hoop-girders of similar kind and construction, except that a certain number of the latter were fitted with king-posts, the plain hoop-girders and those with king-posts alternating from the fifth hoop-girder in rear of the nose. The steering and balancing members consisted of four fins, two horizontal and two vertical, with a single plane (an elevator or rudder respectively) behind each, forming a cruciform empennage at right angles to the surface of the tail. Within the skeleton framework of the Zeppelin at the lowest girder was an internal keel, with a section like a triangle standing on its base. It was about 8 or 9 feet in height at the center, and narrowed down to blend with the structure at nose and stern. The base formed a narrow gangway between gondolas, with a tread of only nine inches, and the bombs were hung beneath in a central position amidships. Attached to the framework of the keel were the petrol tanks, and the water-ballast bags were placed between its outer sides and the main framework of the hull. The divisions between compartments were formed by wires running like spokes of a wheel from opposite sides and angles of the hoop-girders thru a central metal disc like the hub of a wheel.

The arrangement of the cars or gondolas was a distinctive feature. The forward car, 30 feet in length, was situated 75 feet from the nose of the airship, and astern of the fifth hoop or transverse frame-girder, one of those provided with king-posts; it was strongly built, boat shaped, and divided into three compartments. In common with the other cars this was provided with non-inflammable windows of cellon of excellent quality. There were two wheels to operate the elevating gear and rudders, and others which controlled the water-ballast bags and petrol tanks. There was also a small keyboard with 60 buttons, corresponding to the 60 bombs carried under the keel, each of which operated a separate bomb-dropping hook and released a bomb as required. Adjacent to the captain's cabin was a small room 6 feet by 4 feet, used by the wireless operator, and containing his instruments, which were supplied with current from dynamos attached to the engines.

The petrol tanks for each engine were carried inside the hull of the vessel, attached to the keel, and well away from the engines, probably with a view to minimize the risk of conflagration in case of a tank being pierced by bullets in a fight with hostile aeroplanes. It is possible that there was a machine gun in each gondola. The propellers were large and somewhat unusual in construction. Besides having a thin veneer of wood laid lengthwise on the surface of the blades, they had a narrow strip of brass riveted to the blades at the tip and for some distance down towards the bosses, with another strip welded over the first. A wire was fixed to this and carried along the blade, embedded in the wood, to the boss of the propeller and thence out to the edging of the opposite blade. This was done on both sides of the blade.

The armament carried consisted of nine machine guns. Each gondola carried one, with two in the aft gondola, and in addition there was a circular platform well forward on top of the hull, and an emplacement built into the stream-line firing at the extreme stern. For communicating with the members of the crew on duty at their respective posts, the commander of the airship had in his cabin the engine-room telegraph for connection with the other gondolas, and in addition telephones and speaking tubes, which enabled him to keep in touch with the different parts of the airship.

[Modern Aerial Armies. By José Carnó. *Memorial de Caballería*, Jan, '17. 3000 words.]

(Notes translated from a book entitled *Les Armées Aériennes Modernes*, by Lt. Lafont of the French Navy.)

Data are given of the aeronautical strength of all the important states prior to the European war. The third chapter of Lt. Lafont's book describes the work of aircraft during the first six months of the war.

A second book by the same writer is promised covering subsequent operations and commenting upon the

lessons of the war with reference to aeronautics.
(To be continued)

[Has Germany the Command of the Air? *Scientific American,* Jan 13, '17. 250 words.]

A German officer, in a letter now in the hands of the British, throws some light on the disputed question as to which side commands the air on the western front. He states that in his vicinity the English aviators are in great numbers constantly over the German lines, attacking captive balloons and pointing out batteries to English gunners, who fire "fabulous" amounts of ammunition from an "uncanny" number of guns of the heaviest caliber.

[Allied Airmen in Rumania. *Scientific American,* Feb 17, '17. 120 words.]

Fully cognizant of the fact that German success in Rumania appears to have been due to a superior air fleet as well as preponderance of heavy artillery, the British and French governments have sent a large number of aviators, observers, mechanics, and other personnel, together with their equipment, to the aid of the Rumanians.

[Modern Aerial Armies. By José Carnó. *Memorial de Caballería,* Mar, 17. 3000 words.]

(This is the concluding chapter of a series of notes on a work on "Air Craft," by Lafont.)

Aerial reconnaissance by the French during the first days of the war was incomplete because of the lack of machines and pilots. The Germans were more active and made numerous reconnaissance flights daily. Paris could not have been attacked by *taubes* had its defenses been less rudimentary. The defense from air attack was not organized until October, 1914. Altho effected then with some degree of method it was really an improvization because the subject had not been studied carefully prior to the opening of hostilities.

At first it was very difficult to distinguish friendly from hostile air vessels and troops were directed to exercise great caution in firing upon them. This fact was of assistance to German airmen in their expeditions against Paris.

An Austrian constructor, named Ettrich, invented the *taube.* It is said that he got his idea from observation of the leaf of the zanonia, an Indian tree. This leaf is so shaped that it is often carried by the wind for several kilometers under marvelous conditions of stability. The German army had on hand 250 taubes at the beginning of the war. After the initial flights modifications were made which improved this type.

The *taube* can rise 1000 meters in 8 minutes with 300 kilograms of useful load.

Lafont describes the attack of a convoy near Neuville by an airplane. The results were a loss to the convoy of 30 men and 50 horses killed and wounded.

He believes that combat and bomb dropping are not the most effective functions of airplanes but that their primary rôles are those of artillery observation and reconnaissance.

(Various "air raids" including those against Friedrichshafen, Cuxhaven and the first raid upon the English coast are commented upon.)

[Berlin Estimates of Allied Aerial Losses. *Scientific American,* Mar 3, '17. 100 words.]

From the beginning of the war to Jan 31, 1917, the Germans, according to official statistics from Berlin, have destroyed 1002 hostile aircraft valued at 50,000,000 marks, and have put out of combat 1700 hostile aviators.

[The Fourth Arm in Warfare. By Laurence LaT. Driggs. *Outlook,* Mar 21, '17. 3600 words.]

Infantry, cavalry and artillery—long supreme in warfare—must now be supplemented by aircraft. Early in the European war airplane scouts discovered the magnitude of the German movement thru Belgium, and thus probably saved the Allies from disaster. From then on there has been a struggle for the mastery of the air. Germany had the advantage at the start, with a better airplane engine and more machines and pilots than other nations. Among the spectacular phases of airplane work in the early part of the war were Lt. Immelman's flights over Paris at 5 o'clock every afternoon, dropping bombs and messages. To-day Paris is adequately defended against aerial raids by anti-aircraft guns, observation towers, listening towers and searchlights, besides which three airplanes are up day and night at altitudes of 1000, 6000 and 10,000 feet respectively, on patrol.

Raids are secondary in military importance to the duty of reconnaissance, by which positions of artillery, movements and concentrations of troops are observed. Reconnaissances are organized before daylight. First, a fast-climbing patrol mounts to an altitude of 18,000 to 20,000 feet to watch for hostile anti-aircraft movements. Next follows the reconnaissance squadron of twelve to fourteen tractors, each armed with a machine gun. These guns fire thru the propeller by a synchronizing device which permits the gun to fire only when the bullets will clear the blades. Three of the machines carry pilot and observers. The others are "single-seaters," faster and handier to maneuver. Each squadron covers an area fifty miles front by twenty-five miles deep. Anti-aircraft guns have driven the reconnaissance machines up to an altitude of 12,000 feet, and even at this altitude the guns sometimes find their marks.

The airmen are from eighteen to twenty-three years old as a rule, as this age best combines daring and caution in the degree required of a flier. A few months' duty uses up the average pilot and he is then used in training schools or as an observer as occasion requires.

As the squadron ascends the three two-seaters reach an altitude of 8000 feet about the time the single-seaters reach 12,000 feet. Then they separate and the observation machines and their quota of lighter machines proceed to the allotted sectors of their assigned front. These sectors are carefully scanned and compared with yesterday's map for any changes. This work is occasionally interrupted by the attack of hos-

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tile airplanes. In combat, the pilots jockey for the upper berth in the air, as the additional height gives better observation, less danger from artillery fire and height can always be converted into speed when occasion requires.

The airplane patrol of the seas is almost as important as that of the air, for by this means the lurking submarine can be observed and perhaps destroyed by dropping explosives.

As an artillery spotter, the airplane has shown wonderful efficiency, and mastery of the air is essential to the full utilization of the power of the artillery. The airplane is also the most effective defense against the Zeppelin. The German raids over England have produced results not fully known, and nine Zeppelins have been lost, but the raids have served to make England an airplane camp and thus reduced her aircraft strength at the front. However, it is the airplane armed with the Lewis gun that has brought all the raiders to the earth.

The Zeppelin is a difficult target, with all its bulk. But the airplane presents a target only about four feet square, moving at a greater speed. At 100 m.p.h., the speed is 150 ft. per second. At 12,000 feet. an airplane moves 500 yards while an artillery projectile is traveling from the ground to that level.

Bombs are now dropped with great accuracy from airplanes by an electrical device which drops the bomb and arms its fuse at the same time. The bombs weigh 10 to 150 lbs. Sometimes a suspended pilot weight is used on the bomb which serves to explode the bomb in the air.

In Dec, 1916, the Allies claimed to have destroyed or captured a total of 1900 German and Austrian airplanes. The loss of the Allies was probably greater. It is not so much the loss of the machines as the loss of the aviators that counts. "You can build a thousand airplanes a month, but you cannot train a thousand pilots a month." This saying contains its warning. Forty factories are turning out in England a thousand airplanes a month, but disconnected reports indicate that England has lost more machines and pilots from accidents due to lack of training than thru hostile attacks.

Both combatants are straining every nerve to secure the mastery of the air, and the struggle will be watched by the beneficiaries below—the infantry, cavalry and artillery.

[The Offensive Aloft—1917. *Sphere,* Apr 21, '17. 400 words.]

The past ten days have been a period of intense aerial activity. Condensed reports show:

Apr 6. Fifteen hostile (German) machines destroyed and thirty-one others seriously damaged. The Allies lost twenty-eight machines.

Apr 7. Great bombing activity. Four hangars in one German aerodrome and one kite balloon destroyed.

Apr 8. Two German machines destroyed and five others sent down. Two kite balloons destroyed. Ten Allied machines lost.

Apr 11. Four German machines destroyed and five others damaged. Six Allied machines failed to return.

Apr 12. One German machine destroyed and four others driven down. Three Allied machines lost.

Apr 13. More intense aerial activity. Four German machines destroyed and six driven down. Twelve Allied machines failed to return.

Apr 14. Fierce aerial fighting. Four German machines destroyed and eleven driven down, many of which crashed. Ten Allied machines lost.

[Aeronautics in the Great War. The Captive Balloon and the Important Work It Performs. *Army & Navy Gazette,* Apr 14, '17. 1700 words.]

Experience has shown that in the present phase of the war, so closely resembling actual siege operations, the captive balloon is needed for certain services in which it cannot be replaced by the airplane or the dirigible. For this comparatively motionless point of observation presents the same advantages over the ever moving airplane that a fixed post sentinel has over a patrol. The observer in a captive balloon has continuously before his eye the entire terrain. With a telescope and a map, he need lose no detail of what happens within the vast field of his horizon. By means of his telephone he is in constant communication with the ground. Even if distances are such as to afford him only a remote and very general view of his objective, his indications will be sufficient to dictate the opportune moment for launching several airplanes for a detailed reconnaissance.

The value of the captive balloon in directing artillery fire is also recognized.

The elongated form of captive balloon has supplanted the spherical form because of the ability of the former to withstand strong winds. It is equipped like a kite for self-orientation in the wind.

[Progress in Aeronautics. By Major H. Bannerman-Phillips. *United Service Magazine.* May, '17. 3200 words.]

The dirigible will be needed in war for strategical reconnaissance more than anything else, but its development for that specific purpose is sure to bring in its train the possibility of its utilization for aerial transport in travel, exploration and commerce. The points to bear in mind when discussing the policy of building rigid airships for the British navy are: (1) They can remain aloft 48 hours or more, endurance being determined by the amount of fuel they can carry. (2) They are the only safe craft for oversea long-distance voyages by night, and for carrying wireless equipment of long range. (3) They lend themselves more readily than seaplanes for observation in spotting for the guns of a fleet, as they are able to keep station and remain more or less in any selected position with regard to the vessels to which they are attached, whereas a heavier-than-air machine must move the whole time it is in air. (4) While the strictly aggressive value of the large rigid airship has been proved to be greatly overrated by those who expected to see wholesale destruction carried out by its means, the failure to achieve

destruction has been due partly to the manner in which defensive measures have been carried out against Zeppelin raids, and partly because the raider cannot reckon upon doing damage to any particular objective of limited size unless he is prepared to risk sacrificing his vessel and its crew in coming down sufficiently close to the target to make certain of hitting it. However, the destructive power remains the same, and the deterrent value of the large airship is of considerable military importance regarding the conduct of a war, as interfering with traffic and hampering the output of munitions. In addition to this, the aerial defense of localities is bound to immobilize a number of men, guns, machines, and stores which would otherwise be employed on the fighting fronts. For this reason, if for no other, the rigid airship has justified its existence from the German point of view.

The co-operation in the German navy of their dirigibles with their surface vessels has enabled them to avoid unduly risking the latter, and by their aid the German submarines have been put in a position to do far more damage than they could have done if unassisted, and the British navy has been seriously handicapped by the lack of similar aircraft. Therefore, Germany is bound to be better informed as to the strength and movements of opposing sea forces, and is able at the same time to economize in the use of surface vessels as scouts and reserve and concentrate her naval forces for decisive action at the right moment.

Seaplanes can only carry out scouting duties for a fleet up to a certain point, and strategic reconnaissance is out of their power. They cannot keep station with a fleet, and the necessary floats render a seaplane heavier and more unwieldy than a large airplane and proportionately slower; their radius of action is limited by day and the risk of using them for long distances by night would always be serious, while the floats and want of quick climbing power militate against their advantageous use in attacking enemy airships at sea, as compared with the employment of airplanes for similar purposes overland.

Considerable attention has been drawn to the number of machines lost by the British and the proportion of casualties in February and March. Such sacrifice may be necessary and the leaders know their business too well to permit valuable lives and costly material be needlessly thrown away. In addition, the inclement and cloudy weather has often been of considerable advantage to the German airmen. Again, the Germans have reversed the tactics which they practised some time ago, and have rehabilitated, reorganized, and strengthened their air service, and have apparently directed their airmen to take the initiative boldly and not wait to be attacked.

Not only have the machines been improved, but the pilots, as well as the gunners and searchlight crews, have had the benefit of considerable training unknown in pre-war days, together with hitherto unattainable experience of what the conditions of night-hawking for airships would mean. The Zeppelin is well armed and can rise far quicker than the airplane, altho it cannot travel so rapidly in a straight line. If the airplane can be seen above the airship, the machine-gun mounted above the gas-container can come into play, and as the crew of the raider know that search is being made for the vessel, they are bound to be keenly on the alert to get in the first shots.

The war has given expenditure, competition, and a better market for engines, with excellent results. The machines are made in quantities and the stresses to which they may be exposed are better understood; the factor of safety can be allowed for with reasonable certainty. Every part is tested to far above the severest strain which it may reasonably be expected to bear, while the parts can be standardized and manufactured in quantities so as to be tested and held in readiness for immediate repair and replacement.

[The Air Raid Over London of June 13, 1917. *Sphere*, June 23, '17. 600 words. Illustrated.]

Two air raids have occurred this week, one by airplanes at 10:40 a. m. (true time), June 13, and the other by two Zeppelins the night of June 16-17. The airplane raiders reached London, did considerable damage and got away unscathed. One of the Zeppelins was destroyed.

It takes an airplane only an hour and forty minutes to fly from Ostend to London at a speed of 90 m.p.h. Examination of an unexploded bomb dropped by one of these aircraft revealed the fact that it weighed over 100 lbs.

[The U. S. and Allied Supremacy in the Air. *Army & Navy Gazette*, June 23, '17. 500 words.]

By natural aptitude of her pilots, thru the rapid expansion of her manufacturing resources, and by reason of the appropriation of ample funds ($600,000,000), the United States will play an important part in securing and maintaining the absolute supremacy of the Allies in the air on the Western Front. It is known that Germany intends to make another big effort to assert herself in the air, and that it cannot be fully realized until 1918, when she will have 3500 airplanes at her command. But the United States alone should be able to provide that number, and she needs no reminder to cause her to push forward her efforts in co-operation.

[Flying Machines During the War. By P. *Artilleri-tidskrift*, Parts 1 and 2, '17.]

(This article describes the various machines used during this war by Germany, France, England and Russia.)

[To Strike at the German Fleet and U-Boat Bases from the Air. Statement of Rear-Admiral Bradley A. Fiske, U.S.N., Retired, to the Senate Sub-Committee on Military Affairs. *Flying*, July, '17. 2280 words. Illustrated.]

It has been apparent to most impartial students of strategy in this country from the early days of the present war that the probability was that the war would go to the advantage of Germany rather than to the

AERONAUTICS—Continued

advantage of the Allies. If the United States were prepared to throw large numbers of trained troops under trained generals into the field, and to assist the navies and armies of the Allies with great numbers of aircraft, our entry into the war would have an immediate and decisive effect, and perhaps there would have been no war; but we are not prepared to do these things, and so it becomes necessary to consider along what line we can work, in order to be able to help the most effectively and the most quickly.

The breaking out of the war showed that trained efficiency of the German nation which army and navy officers expected would be shown.

Doubtless the sending of American troops to French soil will help the Allies there. It is generally accepted now, however, that we can contribute more effective assistance by means of aircraft with trained aviators and appropriate armament; because this particular kind of work the independent character and inventive ability of the American enable him to do with more enthusiasm and success than almost any other kind of work.

The coming and going of French, Italian and Argentine ships is seriously hindered, and the combined merchant service of Great Britain and United States is unable to remedy the difficulty. The losses in tonnage continue to be greater than the amount replaced, and there is no sign of betterment.

During the past three months there have been submitted to me from two to three inventions a day on an average for overcoming the submarine menace. They all seek to protect a ship from a submarine, or to find a submarine after it has gotten into deep water. I have worked more or less continuously at the problem myself for three months, but have not been able to come to any conclusion except that the only way to stop the submarine menace is to prevent submarines from getting into deep water where they can submerge.

The difficulty about accomplishing this is that the waters near the Belgian and German coasts are shallow and are mined besides. The trouble abcut removing the mines is that this must be done by small watercraft, and that German battleships and cruisers can thread their way thru the mine fields, knowing where the mines are, and drive off any small craft trying to remove the mines. It seems essential, therefore, that we must be able to drive off the German ships. There seems to be no way of doing this except by some craft which is not hindered by mines; that is, by the torpedoplane.

For raids on naval vessels the strategical advantage lies with the Allies because their control of the deep parts of the North Sea enables them to establish a temporary aeronautical base of mother ships sufficiently close to the German fleet to enable the British to launch a torpedoplane attack from it on the German fleet in Kiel and Wilhelmshaven, while the Germans could not possibly establish an areonautical base sufficiently close to the British fleet. This gives the Allies the great advantage of the offensive. It would be possible, provided a distinct effort is made, for the Allies to send a large number of airplane mother ships to a point say 50 miles west of Heligoland; and for a large force of fighting airplanes and torpedoplanes to start from this place about two hours before dawn, reach Kiel Bay and Wilhelmshaven about dawn, attack the German fleets there, and sink the German ships. The distance from Heligoland to Kiel is about ninety land miles, and to Wilhelmshaven about forty-five.

If the German fleet can be disabled, the Allies' navies can countermine and drag out the mines from the shallow waters near the German coast, and can then prevent German submarines from getting into deep water, where they can submerge.

As soon as this is done, fuel can be supplied to France, Italy and Argentine, food can be transported in unlimited quantities to Great Britan, France and Italy, the last chance of overcoming England be removed, and with it the last chance of overcoming Italy and France.

In other words, the elimination of the U-boat menace will be the elimination of the German menace.

[A French Aviator's Message to America. By Lieut. de la Grange. *Aviation,* July 1, '17. 2500 words. Illustrated.]

The air belongs to everyone, or rather to him who knows how to conquer it with a high hand. There traps do not exist, nor hidden machine guns, nor other obstacles that warp the conditions of the fight. In the sky there are two men, armed alike, who fight like knights of old in their tournaments. The French love the risk and the danger; they play the game well, but they hate treachery. Those who give themselves up to the skies of France in 1918 will take part in a great battle, the prize of which will be the supremacy of the air. If we lose, our military operations will be hindered, and our towns, whose sons have given their lives in defending them, will be exposed to the destruction wrought by German aviators. If we win, the field will be cleared for our enterprises. Our armies will regain complete liberty of movement, while the German army will be deprived of its most precious source of information. Our bombing squadrons will harass reserve forces and attack all the important strategic points behind the lines, and the Germans will not feel secure anywhere.

Three different types of machines are used in modern warfare—the fighting, the reconnaissance, and the bombing machines. A fighting machine must have the following qualities: speed, handiness, great climbing ability, and high ceiling. The constructor must bear this in mind, and never sacrifice one of these qualities for the benefit of one of the others. It is not rare nowadays to meet German airplanes at a height above 18,000 feet. Our machines have always been, and are still, more handy than the German ones. This is one of the reasons why our fighters have been so successful. The reconnaissance machines ought to have the same qualities as the fighting machines, but naturally they cannot have them to the same degree, because they have to carry more weight, and therefore

they are bulkier. The landing speed of these planes is a factor that must be taken into consideration for two reasons. The first is that as the best pilots will be used to fly the fast fighters, those that are left to fly the reconnaissance machines are often less skillful. The second reason is that night flying is becoming more and more necessary.

It has proved useful to have four reconnaissance squadrons of fifteen machines each for every army corps of two divisions. In theory every airplane should be able to defend itself. It must not be forgotten that speed and climbing ability will often be as good weapons as machine guns. As a rule there is no danger in flying because of defects in the machine. The great danger comes from the high speed at which one must fly, which makes the slightest mistake made by the pilot when he is near the ground fatal. All modern machines are of the tractor type. The reason is that in theory each airplane should be able to de fend itself.

Before an engine of a new model is accepted by the French army it undergoes a test of fifty hours. During five days it runs twice a day for five hours, during a half-hour of this time at full power, and for four hours and a half at nine-tenths of that power. The plane itself can easily be built; the same cannot be said of the engine. The constructor is limited by weight, and has to solve the difficult problem of designing an engine weighing about two lbs. per horse power, which will be reliable and not cumbersome. The automobile engine does not work at full power at all times as the airplane motor does. The constructor will have to use remarkably good material. The steel must be of high resisting power and yet be not brittle. Lately most of the cylinders have been made of steel, but it is possible that cast iron may again come into use if we want to build engines turning at 2000 or even 2500 r. p. m.

It is almost impossible to say beforehand whether a man can become a good aviator. Some of the very best French pilots were in such bad physical condition that they were rejected by the army. An aviator must always do individual work, consequently he must have a great sense of duty. He must also be more intelligent and better educated than the average infantryman. The more mechanical and engineering knowledge that a pilot possesses the better it is. A good pilot is always busy with his machine when he is not flying. The life of the pilot is in the hands of his mechanic. The latter must be competent and careful. Each pilot in a squadron has two mechanics to take care of his machine. One of them is an expert and takes care of all the fine mechanical work, while the other cleans the engine, oils it and fills the tanks. It is impossible to train a good mechanic rapidly.

[. . . Work of Aviators on the Western Front. . . By Capt. de la Grange. *Official Bulletin*, July 14, '17. 1500 words.]

At the beginning of the war the German aerial fleet was composed of 300 machines, the French fleet of 100. Even in the early days of the war the aircraft were forced up to altitudes 9000 to 10,000 feet by rifle and machine gun fire. Much was learned. The French air service enabled the retreat from the Meuse to the Marne to be made without disaster. After the Marne, a great air fleet was demanded. The French construction forged ahead and in 1915 they had a great advantage over the Germans. The German industrial organization enabled them to draw even again in 1916. France had to build for both England and Russia in addition to supplying her own needs.

In open warfare, the principal reconnaissance is by airplane. In trench warfare it is the only means of gaining information and the principal means of controlling artillery fire. There are four types—reconnaissance, spotting, fighting and bombing.

The fighting machines operate in squadrons of 10 and 16 machines, seeking out and attempting to destroy hostile machines. Bombing machines operate in squadrons at night and drop explosives on enemy works. They have carried out reprisals for the German raids on England. The bombing work is very dangerous. Since 1915 the spotting machines have directed the artillery fire, communicating with the batteries by wireless. Now the task of keeping track of the infantry in attack has been given to the spotting machines on account of the fact that other means of communication are subject to interruption. The spotting machines report the position and progress of the infantry. This work is extremely dangerous and many machines are lost, but it saves thousands of infantrymen's lives.

[Great Fleet of Airships . . . Would Defeat Germany. . . . By Capt. de la Grange. *Official Bulletin*, July 19, '17. 800 words.]

There has been a great development of aircraft since the beginning or the war, both in numbers and in speed and power. The models change rapidly and a machine is soon out of date. If there is any delay or hesitation about the construction of new types, difficuties will at once arise in that type due to the superiority of enemy.

At the end of 1916 the French aviation service was not homogeneous. The spotting and reconnaissance machines were not of the newest type, whereas the fighting machines were superior to those of the enemy. In 1916-17 the allied fighting machines were able to keep command of the air, but they were too few in number. There are two possible remedies, to improve the spotting and reconnaissance machines or to build more fighting machines. But it is difficult for the Allies to make a great industrial effort. There are about 3000 Allied airplanes against about an equal number of Germans. If the U. S. suddenly threw into the balance 4000 or 5000 airplanes in 1918, it would give the Allies such a preponderance as to establish complete supremacy. This would mean information for the Allies and none for the Germans. Lives and ammunition would be saved, and the maximum advantage could be taken of any piercing of the line and consequent retreat. A big U. S. air fleet in 1918 would mean victory for the Allies.

AERONAUTICS—Continued

[My Personal Experiences. By Lt. Col. L. W. Rees, V.C., M.C., R.F.C. *Air Travel,* Oct, '17. 2440 words. Illustrated.]

Patrolling is very dull work. One fearfully cold morning, after about two and one-half hours in the air, we saw shells bursting in the distance. We located the enemy machine and made for him. As soon as he saw us he made for us and when he was quite close he fired about six rounds, one of which bent a valve on my engine. My gunner put his gun out of commission and the enemy having only two automatic pistols left, dived thru the clouds. We followed and cut off one of his wings, causing the enemy machine to plunge to the ground, narrowly missing one of our machines directly under it.

Shortly after my squadron was moved to another part of the line and had a lot of photographing to do. This is not a popular amusement, as one has to get a certain altitude and stay there, regardless of anti-aircraft guns. Once on returning with some photographs we met a twin motor enemy machine and diving at it, put one of its motors out of commission. It was quite amusing to see the pilot try to maneuver with the one motor. He finally landed and ran into a fence behind his own lines. Nearly all of the fighting takes place behind the enemy's lines.

One day we met an enemy machine which dived toward a point about three miles behind the lines. We followed at about 300 yards but did not hit him. At about 800 feet the enemy straightened out and left us diving at an anti-aircraft battery. The battery opened fire, but we were going so fast pursuing the other machine that we were not hit. The enemy kept going over woods and villages, much as tho he were in a steeple chase and we, while following him, were the target for all the road guards that we passed over.

We crossed the trenches at about 1000 feet and could hear thousands of rifle and machine gun bullets whistle past. However, after landing we found that the machine had been hit by only one bullet. Every morning regularly, we used to drop bombs on a particularly annoying anti-aircraft battery, but the closest we ever came to him was to drop two bombs about 20 yards on each side of him.

The last partol in the evening spots the gun flashes and brings back their location. So that all firing usually stops as a machine approaches. The machines carry special flares to land by. One evening I had a special flare of new design to try out. The flare did not work properly, the night was dark and as a result I crashed when still a little way from my airdrome. The engine control broke, the engine raced and showed a green light; the red lights and signal lights went off and made a very pretty scene. This crash finished the machine which had carried me successfully for over 100 hours.

A flying instructor has one of the most exciting jobs in the world. He never knows what a pupil will do in the air. Pupils can have all kinds of accidents without hurting themselves. The following are good examples: One pupil left his tail on one side of the road and continued on the other without realizing his loss; another tried, unintentionally, to fly into a hangar when the door was closed. However, these accidents usually tend to give the student more confidence.

In 1916 I formed a fighting squadron equipped with single seater fighters. On one morning I went from London to the Headquarters in France in two hours and a half. The two hours were taken up in getting from London to my machine by train. When we go on bomb raids the airdromes are lighted so that the machines can find their way back. One night the Huns and ourselves were both out bombing. About 2 A. M. a machine came down and landed and when the pilot stepped out he spoke in German and was immediately placed under arrest. He had mistaken our lights for his own.

Our airdromes are usually out of gun range, behind the lines. Two squadrons I know of have been shelled out of their airdrome. As most of our work is done above 6000 feet and it takes at least six minutes for a machine to get that height, the machine will have gone from five to ten miles in that time.

—Use of in Lifesaving Service

[Use of Aircraft in Saving Life and Property at Sea. By Capt. B. M. Chiswell, U. S. Coast Guard. *Aviation,* Mar 1, '17. 1488 words. Illustrated.]

The records of the Coast Guard Service show that in doing their duties the coast guard during the year ending July 1, 1916, assisted floating property to the value of over ten and one-half million dollars, brought in over $100,000 worth of derelicts, destroyed over thirty that were a menace to navigation and saved over 1200 lives. The S. S. *Maryland* sent out S. O. S. calls that she was leaking badly, but in spite of the fact that two cutters started to her assistance at once no trace of the ship or her crew were ever found. It is believed that a seaplane located at Nantucket could have reached the spot where the *Maryland* was about 15 to 20 hours ahead of the cutters and thus might have succeeded in directing the cutters. Frequently steamers catch fire and their crews are rescued by other ships, the hulls are brought in by coast guard boats after long search. Sometimes the object sought is found a hundred miles or more from its reported position. It is believed that this condition can be much helped by the development of a seaplane that can go to sea with a reasonable chance of getting back, that can alight on and arise from a reasonably rough sea, that can be navigated with reasonable accuracy and can send a radio message 100 miles or more. Such a machine will be about 15 times as efficient as a coast guard cutter.

—Use of Wireless in

See

WIRELESS TELEGRAPHY—AERONAUTICAL

[Note. *Army & Navy Journal,* Feb 17, '17. 70 words.]

Captain Clarence C. Culver and Lieut. Herbert A. Dargue made a successful test of radio-telephone com-

munication between a military airplane in flight and a land receiving station at the Signal Corps Aviation School, San Diego, Cal., Feb 7. Captain Culver, who talked into the instrument in the airplane, was heard in the receiving room three miles distant.

[Wireless Telegraphy on Aircraft. Anonymous. *Schweiz. Zeit. f. Art. u. Genie,* May, '16. 1000 words.]

Wireless telegraphy is now installed on all aeroplanes and Zeppelins. The complete apparatus consists of a dynamo (500 to 750 watts) operated by the motor of the machine, and a sending apparatus. The length of the antennæ wires varies from 60 to 300 m. The sending apparatus is very simple and for its operation a knowledge of telegraphy is sufficient. The method of operation is (1) unwinding and lowering the antennæ; (2) cutting in the generator; (3) sending.

It is now known that the Zeppelins were already equipped with wireless in 1912. German aeroplanes were equipped a short time later. Concerning this equipment nothing is known.

AFRICA

See also

EUROPEAN WAR—GENERAL NOTES ON OPERATIONS BY THEATERS—AFRICAN THEATER

AGE LIMIT

—For Officers

[Men Under 31 Wanted for Officers' Training Camps. *Official Bulletin,* July 6, '17. 800 words.]

To correct a general misunderstanding, the War Department announces that men under 31 are particularly wanted for the Aug 27-Nov 26 training camps, and that lack of military training will not operate as a bar to acceptance. What the Government wants is brains, courage, and physical ability to stand the test of war.

AIRCRAFT

See

AERONAUTICS

AIRPLANES

See

AERONAUTICS

ALBATROS AIRPLANE

[The New Albatros De Chasse. *Aerial Age Weekly,* April 30, '17. 784 words.]

The Albatros Destroyer is known as the Type D-1. and the example illustrated was shot down about Dec 1, 1916, on the British front.

It carries two machine guns, one at each side of the engine. The fabric of the wings, like the fuselage covering, is painted green and red-brown on top, and pale blue below, similar to other German destroyers.

General dimensions:

Span, upper plane................8.6 meters
Length, overall..................7.3 meters
Motor, Mercédès................170 h.p.

Lower wings are fixed to the fuselage on a bracket which sticks out beyond the rounding of the monocoque. The upper plane is in a single unit.

The spars, like the wings, finish with an outward slant, and are bevelled off sharply on the top side.

Ailerons on upper plane, 2.38 m. in span by 0.41 to 0.52 m. chord. Surface, 1 sq.m. each.

The wings can be staggered as desired. This arrangement is probably made so as to alter the center of pressure to allow for alteration in the size and weight of the motor used, and also possibly for the weight of the pilot. The c. p. is thus shifted longitudinally and the weights correctly adjusted instead of adopting the usual method of merely changing the angle of the tail.

There is a single pair of interplane struts of streamline section on each side of the fuselage.

Motor, 6-cylinder Mercédès, which gives 170 h.p. at 1450 r.p.m. The propeller is 2.8 diameter.

The exhaust pipe is pointed obliquely backward and downwards. The two radiators are of a new form, fixed one on each flank of the fuselage outside, one being thicker horizontally than the other. Their position necessitates a gravity tank, flat and triangular, which is located above and to the left of the camshaft. The air pump, with machine gun in front, is fixed above the front of, and not behind, the camshaft.

ALLOWANCES

See

PAY, ARMY

ALUMINUM

[Aluminum in Modern Automobile and Aviation Construction. By James E. Diamond, Chief Engineer, Aluminum Castings Company. *Aerial Age Weekly,* Dec 18, '16. 2200 words.]

The smallest cylinder casting is the one where each cylinder is a separate unit, the next larger casting is where the cylinders are cast in pairs, both L-head and overhead valve types being constructed. Next come the 4 or 6-cylinder block castings, occasionally an L-head construction, but the overhead construction is the usual type. By far the larger number of aluminum engines are those in which the cylinders and crankcases are integral. This is an extremely rigid construction and much lighter than the iron engines. The Marmon and the new Premier engines are of this type. The casting of the V-type engines with crank case and cylinder blocks in one unit seems to be a favored construction among American aviation engine builders at this time. The engines built so far with aluminum cylinders have been of the 12-cylinder overhead valve type. The outside diameter of the cylinder barrels is made larger than would be the case with an iron engine, thus accommodating a cast iron or steel sleeve. These sleeves are either a drive fit and forced into place with a light press, or steam or hot water is run thru the jacket space and the sleeve dropped into place. In the overhead valve construction this sleeve is flanged at the upper end, fitting into a corresponding recess. Engines now in production seem to have a cast iron head; the idea apparently is "Safety First" in spite of the desire

ALUMINUM—Coninued

to use an aluminum head. Aluminum has demonstrated its ability, if properly designed, to stand both explosion pressures and combustion temperatures. The difficulty has been with the valve seats. It has worked out satisfactorily for the valve seats on the intake side but not so well on the exhaust side. The metal does not melt but becomes soft and consequently does not stand the constant pounding. The Peugeot Company has used aluminum in its latest racing engines and the valves, of which there are four to a cylinder are seated directly in the aluminum. The aluminum piston has come, and has come to stay. A long piston with a reasonably thick skirt is recommended; the length should be equal to one and a third times the diameter of the piston. This will take care of piston slap and help materially in preventing oil pumping. The piston unquestionably is the heart of the engine and the engine should be built around the piston.

There are two types of intake manifold, one a unit in itself, the other contained entirely within the cylinder head casting. The Pierce Arrow Company has always built bodies of aluminum castings. When the various sections are carefully proportioned, the extreme bracing required in sheet metal body constructions is unnecessary. By the elimination of these braces, sufficient weight can be saved to make the body lighter for equal strength than the more commonly employed construction. The body is more rigid and sturdier than the sheet metal body can possibly be and the possibility of body squeaks is eliminated; warping and buckling cannot occur and the body will outlast the engine. It will stand punishment that would be absolutely destructive of the ordinary sheet metal body. In a great many cases the clutch cone is an aluminum casting faced with suitable brake lining, steering wheel spiders are almost invariably aluminum, aluminum carburetors are almost invariably used on aviation engines altho not much thought has been given the question of aluminum carburetors for automobile engines. Aluminum fans are also used on many cars. Aluminum brake shoes have not been much used in America, but in Europe both the Panhard-Levassor and the Peugeot companies use Cothias permanent mold aluminum brake shoes on all their models. Casting for casting, aluminum can be machined nearly twice as fast as cast iron. Fewer men and consequently smaller floor space is required when the shop is laid out to machine aluminum. When the market is normal, considering initial costs, casting for casting, it will be found it is cheaper to use aluminum than iron. Aluminum crank case walls should not be made thinner than 3/16 of an inch, 7/32 is better. Aluminum has an extremely promising future and when it is recalled that the output has increased from 283 pounds in 1886 to 136,400,000 pounds in 1914, the tremendous strides that have been made will be appreciated.

AMERICAN REVOLUTION

—Naval Operations

[Sea Power and the American War of Independence. By Admiral the Hon. Sir E. Fremantle, G.C.B., C.M.G. *Jour. R. U. S. Institution*, Aug, '17. 14,000 words.]

(A study of the operations of the British and French fleets during the American War of Independence.)

AMMUNITION

See also

- BULLETS
- EXPLOSIVES
- FIELD ARTILLERY—AMMUNITION
- MARSITE
- MUNITIONS
- SHRAPNEL

—Manufacture of

See also

- STELLITE

—Supply and Transport of

See also

- FIELD ARTILLERY—AMMUNITION—SUPPLY SERVICE

[General Plan of Supply of Munitions from Productive Centers to the Firing Line in the Swiss Army. By Capt. D. Luis Dernandes Herce. *La Guerra y Su Preparación*, Mar, '17. 250 words.]

The division park consists of 219 wagons which transport 2,324,160 rifle cartridges and 12,640 artillery projectiles.

The territorial service manufactures munitions and turns them over to the munition trains, which convey them to the base, where they are turned over to the service of communications. This service carries them to the station nearest the troops, where they are turned over to the division parks. The latter carry them to a place designated by the division commander, where they are turned over to the battalion combat wagons. The latter proceed to the places designated by regimental or battalion commanders, whence the munitions are transported by hand to the companies or batteries and immediately distributed to individuals.

[Ammunition Supply. From The School of Musketry. *Infantry Jour.*, Oct, '17. 5000 words. 1 sketch. 2 tables.]

The only valuable system of ammunition supply is one based upon the probable expenditure in battle and upon the principle that fighting troops should never find themselves out of ammunition. All wars since the Franco-Prussian War of 1870 have shown a tendency towards an increasing expenditure of ammunition, due to improvements in firearms and training and the development of fire tactics. Volume of fire is now so important that greater expenditures of ammunition may be expected. Commanders, of all grades, from the commander of the field forces down to the squad leaders, have various responsibilities in connection with the expenditure of the ammunition supply and its proper replenishment.

The line of communication over which our ammunition supply must move may be so long that it will have to be divided into three or more sections. Ammuni-

tion depots are established along this line, with supply columns of motor trucks or wagons to transport the ammunition from the depots of the advanced section of the line of communication to the troops. When the field forces move forward these supply columns then connect with the division ammunition trains which consist of 162 four-mule army wagons. The combat trains are filled from the division ammunition train and march ordinarily in rear of the battalion or machine-gun company to which they belong.

In order that the ammunition supply shall not break down it is necessary for the commanders of ammunition columns, division trains, and combat trains to work together and to fully understand the rendevous and filling points which are fixed in orders. The best methods of getting the ammunition from the combat trains to the firing line must be studied; men should never leave the firing line to get ammunition, it should be sent to them.

Regimental commanders, altho not charged by our regulations with the supervision of ammunition supply, should direct the movement of the assembled combat trains when their battalions go into action, and give instructions concerning the supply of ammunition for the machine guns.

The bandoleer now used is admirable in many respects. A caisson with four mules has been proposed which is superior to the army wagon for the quick handling of ammunition. Methods of distributing ammunition from the combat trains to the troops should be studied in order to get rapidity. Defensive and offensive work require different solutions of the ammunition supply problem, but much can be done to lessen its difficulties by analyzing our system and trying it under varying conditions.

—Use of in European War

See

European war—Ammunition

AMPUTATIONS

See also

Surgery, Military (Article: "Bone Graft Surgery")

ANCIENT WARFARE

See also

Catapult

ANGHERA, Battle of

[Africa. The Battle of Anghera. By M. *Memorial de Caballeria.* July, '16. 1800 words. 2 sketches.]

Negotiations having failed to obtain the submission of the Kabyles it was decided to punish them severely. The terrain in this locality is mountainous, rocky and cut by deep ravines. The principal defenses of the Kabyles were the difficult ground and the lack of roads. They had constructed trenches and covered ways of the Carlist type in anticipation of attack.

On June 29, '16, the Spaniards advanced in 4 columns; viz, the right, left, center, and the reserve. Each column consisted of several infantry companies, a mountain battery, engineer and signal detachments and ammunition, supply and sanitary units. The left and center columns and the reserve, respectively, had one, three and two squadrons of cavalry. Major General Milans del Bosch was in command. The Kabyles were strongly placed on a ridge about 1600 meters west of the fortified post of Federico. The Spaniards attacked in front and on both flanks and completely defeated the Kabyles who fled in great disorder, leaving many dead, wounded and prisoners on the field. The Spanish cavalry did the work, charging and capturing a triple line of trenches and losing heavily in the close fighting which preceded the flight of the Kabyles. The artillery swept the hostile position with fire during the advance to the attack. The engineers were used to open up and improve communications. The signal corps established and constantly maintained communication between headquarters and the four columns, first by visual signaling, later by telephone. Intrenching tools were used in some cases to strengthen positions temporarily held by certain units while awaiting the support of others. This action afforded an opportunity for use in combination of all the arms. The brilliant success is due to the excellent co-operation and the co-ordination of the different arms and columns under the able direction of the Commander-in-Chief.

ANTI-AIRCRAFT ARTILLERY

See also

Aerial artillery

[Attack on Zeppelins. By Brig.-Gen. F. G. Stone, R.A. (A lecture delivered at the R. A. I., Mar 23, '16.) *Jour. Royal Artillery,* Apr, '16. 4000 words. 1 cut.]

The lay mind, and even the military mind, apart from that of the professional gunner, does not grasp readily the fact that the anti-aircraft gun and all that appertains to its service, is a highly specialized creation, and that even with the most perfect and complete equipment, and the most highly trained gunner, the odds are still very heavily against hitting a Zeppelin at night; while with the improvised equipments which have served as temporary substitutes, the chance of hitting has been infinitesimal, and even if a hit should have been scored there would have been no chance of destroying the air-ship in the absence of suitable ammunition. The futility of attacking Zeppelins with field guns is not realized still in many quarters.

The ideal anti-aircraft mounting must allow the gunner to move his gun with the same freedom as a machine gun, and an automatic sight, if one satisfactory can be obtained, would make the equipment perfect. Searchlights must accompany each installation of anti-aircraft guns, fixed or mobile.

The shell and fuse are of vital importance, the only effective shell being a combination high explosive and incendiary shell. The mere penetration of the envelope by a shell is not sufficient to ensure the destruction of the air-ship, due to the physical facts: (1) that hydrogen gas cannot burn except in an atmosphere supplied with sufficient oxygen; and (2) that unless hydrogen

ANTI-AIRCRAFT ARTILLERY—Continued

is mixed with a sufficient proportion of atmospheric air, it will not explode. Therefore the disruptive effect of the shell must bring the hydrogen and air into contact over a sufficiently large area for the subsequent incendiary action to take effect, either by burning or by explosion.

Altho field guns are useless in attacking Zeppelins at night, they have been a valuable auxiliary by day in keeping the Zeppelins at a respectful height, which has eliminated them from the theater of war in respect to raiding operations, which it was predicted the Zeppelins would be able to carry out by daylight as well as by night. It should be kept in mind, however, that every energy must be devoted to attacking the Zeppelins at their own local bases. This is the true defense and any defensive measures for the protection of localities must of necessity be very limited.

The only form of attack on Zeppelins worth considering seriously is by aeroplane, and to be successful, this attack must be well organized and be carried out by a large number of machines, unless there be available battle aeroplanes which not only can overtake the Zeppelin in flight but can rise above it with comparative ease, so as to commence their bombing attack from an advantageous position against the upper surface of the air-ship. Machine gun fire from an aeroplane is useless against the gas holder of the Zeppelin; while the car can carry better armor and heavier guns than can any aeroplane.

The only sure way of securing a decisive result is by bombing attack from above, using a combined explosive and incendiary bomb. The disruptive effect of the high explosive is essential on the instant of impact, to tear open a sufficiently big gap to allow the confined hydrogen to escape in an adequate volume to form an explosive mixture with the air, or even to burn, on ignition by the incendiary portion of the bomb, in the free air to which access has been obtained thru the agency of the high explosive portion of the bomb.

["Archibalds" or Anti-Aircraft Guns. *Sphere,* Nov 4, '16. 500 words. Illustrated.]

Anti-aircraft guns are becoming steadily more effective. At the beginning of the war, reconnaissance could be conducted at 5000 feet. Now 10,000 feet is the minimum altitude for reasonable safety, and the anti-aircraft gun can reach 20,000 feet.

The size of the guns in use varies from machine guns to four or five inches or even greater caliber. The French 75's are used against aircraft. They fire 25 shots a minute and their recoil mechanism is so perfect that they can be fired continuously without relaying.

The German anti-aircraft artillery is particularly efficient, as the Allies know to their cost. The Germans were the first to make special artillery of this kind, and early in the war they recognized the value of mobile anti-aircraft artillery, now extensively used by both sides. Motor mountings greatly enhance the value of an anti-aircraft gun, and correspondingly reduce the number of men required. Anti-aircraft gunnery is extremely difficult to master and long and continuous practice is necessary to proficiency.

[Fire Against Aerial Targets. By Maj. D. Pedro de Obregon. *La Guerra y su Preparación,* Apr, '17. 4000 words.]

The essential features of a weapon for defense against aircraft are: great initial velocity, rapidity of fire, rapidity of movement in direction and elevation, and accurate sights. They are of two types, mobile and fixed. The former are moved by horses or by autos. A suitable caliber is 8 or 9 centimeters. The fixed guns may have a larger caliber, but this is limited by the requirement of rapidity of fire. The maximum satisfactory weight of the load is about 15 kgms. Semi-fixed pieces, for example on the line of communications, must be suitable for transportation after 6 to 12 hours' notice.

Shell is more effective than shrapnel; the effect of the latter, especially at great heights, or against a target moving in the line of fire, is small, and the shrapnel-case endangers friendly troops. In fire against an aircraft, a point of impact is chosen in the path of the target, on the supposition that the latter will maintain the velocity and direction which it had at the point of measurement. The time of travel of the target from the point of measurement to the point of impact must equal the time of flight of the projectile plus the time of delay in firing. During the time of delay, the point of impact is chosen, the firing data is determined, the time of flight and the moment for firing are calculated, and the piece is aimed.

This operation is difficult, as multiple calculations are required in a short time. For this purpose two kinds of mechanism have been devised. The one consists of a sight on the piece, necessitating direct fire; the other is an apparatus for the battery, permitting either direct or indirect fire. The ideal apparatus is a combined aiming device and range-finder, which reduces the time of operation to 4 seconds or less.

There are two methods of execution of fire. One is the "fire of series" (formation of a wall of fire), the other is a continuous fire, in which the target is constantly followed.

The centers of impact of the guns of a battery should not coincide, but should be grouped symmetrically around the most probable point of impact. The shot group should have the greatest possible extension in the line of travel of the target, as well as in the direction of fire. The latter requirement results from the difficulty of determining the range. This procedure also affords better observation of fire. Batteries are most effective by the use of combined sights, and by distributing the fire somewhat toward one flank according to the direction of travel of the target.

[Anti-Aircraft Weapons. By Major Elmer J. Wallace, C.A.C. *Jour. U. S. Artill,* May-June, '17 9000 words. Illustrated.]

Attack on aircraft falls into two classes:

1. Attack by other aircraft.
2. Attack from the earth.

Since gunfire is the prime method used in both cases, it is the only means discussed here.

Targets and Projectiles

The targets presented are the captive balloon, the dirigible, and the airplane.

The principal area of presentation of the first two is the large gas-bag. The personnel and, in the dirigible, the machinery presents a smaller, tho more vulnerable, area. The airplane presents a much smaller target with the vulnerable parts, gas-tank, personnel, and motor, almost always protected by armor 3.5 to 4.5 mm. thick.

The attack on dirigibles and captive balloons should be centered on the inflammable gas-bag. Small flaming projectiles used at short range by other aircraft; light projectiles exploding with a momentary flame on impact; shells with flaming bases, as in the Semple tracer; projectiles discharging a mass of incendiary compounds; all should be effective, and accounts indicate that such devices are being used.

Airplanes are more difficult targets because they are hard to disable by hits on the small area presented. Rifle and shrapnel bullets are usually ineffective against the armored parts, while the unarmored portions permit the passage of small bullets without their endangering the machine. As many as 400 bullet holes have been counted in a still serviceable machine.

Time-fused, high-explosive shells of low fragmentation are reported effective. Effective results might be expected of a shell of as low as six pounds weight, giving four to six fragments on burst. Percussion-fused shells heavier than two pounds could not be used, the retardation experienced not being sufficient to make them function. As they usually fall in friendly territory, percussion-fused explosive shells would be a serious menace to friendly troops. Day and night tracers should be used whenever possible.

Guns To Be Mounted on Aircraft

Guns of low ballistic power will suffice, as aircraft fights are at short range.

Some of the requirements for such guns are:

1. The weight of gun, mount, and ammunition must not be excessive.

2. The recoil must not overstrain the craft.

3. Ability to fire in any direction except when used on craft of high speed and great maneuvering power.

4. Effectiveness against the intended target.

The light high-speed craft use the machine gun. The heavier planes, French and German, use machine guns with the Avion cannon in addition. The French cannon, 37 mm. caliber, fires a projectile weighing about two pounds and is hand-loaded.

Non-recoil weapons are reported. A gun having two barrels joined by an interrupted screw-thread has been used experimentally at Newport News. The front barrel takes the fixed ammunition and the rear barrel a charge of small shot. The force of recoil is taken up in expelling the small shot to the rear. The heaviest gun of this type is a 12-pounder, 210 pounds, 3-inches caliber, with a m.v. of 1100 f.s. The field of fire is limited, as the rear barrel must be pointed clear of the airplane.

A so-called "non-recoil" French gun is described as being thrown forward by compressed air, fired automatically at the point of highest forward velocity, and returned by the recoil, which is taken up by the forward momentum and the recompression of the air.

The machine gun, alone or with the Avion cannon, will probably remain the weapon most used. In high speed single seaters the gun is rigidly attached to the fuselage and fires thru the propeller. By cam attachments the discharge of the gun is permitted only when the propeller blades are clear.

Terrestrial Anti-Aircraft Guns

Belligerents cannot depend wholly on aircraft to combat other aircraft, but must provide great numbers of anti-aircraft guns to protect troops, depots, lines of communication, cities, wharves, etc., and to prevent reconnaissance or artillery observation.

The fire of such guns has been almost incredibly ineffective. Heights of ten to twelve thousand feet give reasonable safety to aircraft, tho the effective range of the guns is much greater. However, much lower flights are taken daily and the percentage of casualties among airmen still remains less than that of any of the other arms.

The Problem of Gunnery

The method of fire control is the controlling factor in the design of gun and mount. The problem of hitting aircraft, due to their speed and small size, is exceedingly difficult. At the average speeds, rates of range change are very great, hence single range finders are of little use. Moreover, gun sights cannot be kept set continuously. The proper angle of elevation is affected by the angle of position and the speed of the target. The sight elevation varies roughly as the cosine of the angle of position, while the correction speed—assuming any one distance and speed, with the target flying in the plane of fire—varies as the sine of the angle of position. With a target flying directly toward the gun, these corrections tend to neutralize one another; hence, for any given speed and distance, one particular calculated sight setting will be correct for all angles of position and need not be changed. As the target recedes, the corrections are cumulative in effect, and the given sight setting is approximately correct at one instant only.

With a target flying in a right line at uniform height, we have six phases of presentation:

Flying in a line passing directly overhead:

1. Phase of approach: distance and angle of position changing at varying rates with neutralizing effect; no deflection for lateral travel.

2. Phase of tangency: target overhead; distance unchanging; travel in angle of position uniform; no deflection.

3. Phase of retirement: distance and angle of position changing at variable rates with cumulative effect; no deflection.

Flying in a line passing at some distance from the vertical thru the gun:

ANTI-AIRCRAFT ARTILLERY—Continued

4. Phase of oblique approach: same as the phase of direct approach, with the addition of deflection for lateral travel which has a variable rate of change.

5. Phase of tangency: the distance and angle of position are unchanging; the deflection for lateral travel is large, but uniform.

6. Phase of oblique retirement: same as the phase of retirement, with the addition of a deflection for lateral travel having a variable rate of change.

These phases may be arranged in the following order as to favorableness of presentation: The phase of tangency above the gun; the phase of tangency on the flank; the phase of direct approach; the phase of diagonal approach; the phase of direct retirement; and, least favorable, the phase of diagonal retirement.

Tactics of Aircraft

Aircraft fly at heights varying from 12,000 to 300 feet, or less, according to the uses to which they are being put. For reconnaissance and artillery observation they will probably fly at a uniform elevation of 3000 to 6000 feet. Travel over enemy territory and bomb-dropping on cities will usually be done at great heights. Bomb-dropping on positions and troops, machine gun fire, and close reconnaissance are frequently combined and are carried out by volplaning to a height of a few hundred feet from the objectve. All airmen alternately dip and rise when under fire.

Fire Direction

The German fire has apparently been more effective than that of the Allies. The Germans, at the beginning of the war, divided the territory to be protected into equilateral triangles six miles or less on a side, according to the maximum effective range of the pieces. One piece is placed at each corner of the triangles and connected by telephone with an observer some distance away. The different guns of any triangle fire shells emitting different color of smoke on burst, enabling the gunners to correct their deflections without confusion. The observer fires his pieces in order and corrects for altitude only, until the shells burst at a common point ahead of the aviator. Only 2 or 3 seconds are occupied in finding the range.

British batteries appear to use coincidence range finders and groups of two to four guns.

Grouping of Guns

Range finding systems furnish the gunners with only approxiate data. Success depends on proper observation of fire. Such observation to be of value, necessitates a high rate of fire. As automatic guns of sufficient caliber for use beyond point blank range are not feasible, guns must be mounted in groups of as great numbers as economy and unity of control permit. It is better to leave dead spaces than to emplace guns singly.

Fire Control

The arguments for gun-grouping lead inevitably to the conclusion that only one battery at a time should fire upon a given target, unless provided with projectiles having distinctive bursts. Fire control will thus be a necessity. This may be accomplished either from a central fire-control station or by pre-arrangement as to sector assignment. To avoid fatal delay the latter will probably be the more practical arrangement, altho a combination of both may be found advisable.

Fire Direction

For guns in groups, the best suggestion for fire direction appears to be the use of a series of concentric zones, accomplished by setting fuses for a series of distances, say 1000, 1500, 2000 yards, etc. Each fuse setting would constitute a hemispherical zone, the thickness of which would be the effective range of shell fragments or shrapnel beyond the point of burst.

A target in the field of fire must pass thru the zones successively, and fire in the zones just ahead of the craft is kept up by flank spotters. Range sections determine the altitude and approximate distance. At some point in each zone the firing data will be correct for fuse setting and range.

Instruments for fire direction must be simple in operation. Self-contained range finders, one to two meters long, vertical angle measuring instruments, and a graphic device for determining range and vertical height from the distance and the position angle are used in Europe.

In general, sights have eye pieces mounted axially in the gun trunnions at right angles to the line of sight, so that the gunner's eye need not move during elevation of the piece. The Grubbs and Schneider sights are fixed, vertical, telescopic tubes with an objective mirror actuated by the movement of the gun. The Krupp sight, by means of cams operated during elevation or depression of the gun, automatically adjusts the sight elevation for changes in angle of position.

Anti-Aircraft Guns and Mounts

The gun designer must consider five fundamental requirements:

1. Difficulties in fire direction have two sources, the time of flight and the curve of the trajectory. As these elements increase, the probability of hitting falls off rapidly, hence the highest velocity attainable is required from gun to target.
2. Rapidity of fire, since the probability of hitting is small.
3. Ease and rapidity in pointing the gun.
4. Hemispherical field of fire.
5. Mobility of mount.

Of these, the conflicting requirements must be compromised. Sustained velocity requires high initial velocity and considerable weight of projectile, necessitating heavy guns and mounts. The other requirements are most easily met with light guns. That gun will be most satisfactory which, while meeting the other requirements, will give the shortest time of flight thru the important ranges.

The inferior limit of caliber would seem to be three inches, as projectiles below this caliber have not been successfully time fused. For visibility of burst against

targets at great heights larger calibers may have to be used. Tentatively, 3-inch guns are sufficient and are most generally used abroad. However, we find the French using 4-inch, the Germans 5-inch, and the English 6-inch. The low attacks are best met by high power machine guns and 1 to 2-pounder automatics while aircraft beyond the reach of the 3-inch are best left to our own battle planes. The relative advantages of fixed and mobile mounts may be summarized as follows:

Fixed Mounts

a. Permit the use of heavier guns and higher velocities.

b. Increase the accuracy of fire.

Mobile Mounts

a. Permit a more effective tactical use of the guns.

b. Allow greater latitude in the location of the guns.

c. Give assurance that the position of the guns will not be known to the enemy in advance, and they may be frequently moved.

d. Permit the withdrawal of the guns more easily from the zone of hostile fire.

e. Allow the guns to be cared for and guarded much more economically and effectively in time of peace.

Information as to the guns used in Europe is complete only to the beginning of the war.

The British attribute great value to the automatic and semi-automatic features. The following description of British and German guns indicates the possibilities in this direction:

The Vickers Company has produced fully automatic guns from rifle caliber up to 2-pounders, firing from 500 rounds (rifle calibers) to 200 rounds per minute (2-pounders) and capable of firing between 10° depression 80° elevation. Tracer projectiles are inserted in these at stated intervals.

A 3-inch, 45-caliber, semi-automatic gun, firing a 10.8-pound projectile with a M. V. of 2700 f. s., is also made by the Vickers Company.

The Krupps had perfected, in 1914, three types of guns—a 12-pounder, 45 calibers, and a 3.4 inch, 35 and 45 calibers, with a 4.1-inch for coast work. The 21-pound projectile has a muzzle velocity of 2067 f. s. in the short gun—2628 f. s. in the larger—and from 20 to 25 rounds a minute are fired.

A 4.1-inch and a 5-inch anti-aircraft gun are used by the Germans. The 4.1-inch gun, 45 calibers, fires a projectile weighing 34 pounds, with a muzzle velocity of 2640 f. s., at the rate of 15 rounds a minute. Its range is 13,200 feet and its shrapnel shell bursts into 625 fragments.

—Ballistics

[High Angle Fire at Aircraft. By Sir George Greenhill. *Aerial Age Weekly*, Jan 29, '17. 1510 words.]

In the calculation for fire at an airship, the work is complicated by reason of the varying density of the air as the shell rises, and because the greater part of the trajectory of the shell is in air of less density than that for which the calculation was made. The first step is making an estimate of the average height reached and of the mean density of the air. For this purpose it is usual to divide the air up into strata each 1000 ft. thick and of approximate uniform density corresponding to about 1 inch in the barometer. The work of making ballistic calculations for long range high angle fire is always tedious, and the absence of rigor in the method would disgust the modern school of analysis. Extra complications are necessary when the target is not stationery at sea level but a swift-moving airship at 10,000 or 15,000 ft. seen on a line of sight pointing up at angles up to 45 degrees. A heavy shell is not needed, but high velocity is imperative in order to shoot straight with long range and accuracy. The limit of range at which an airship should be fired at is reached when the trajectory of the small, light shell becomes too curved for accurate shooting due to the resistance of the air. Altho many practical methods of range finding have been worked out, such as holding a coin at arm's length and determining the distance to the airship by the size of the coin, the best method is to use a Barr and Stroud range-finder and the official range table. The extra complication comes in with the extra variable of the angle of sight up at the target and the variable range. The angle between the line of sight and the axis of the piece is known as tangent elevation. Quadrant elevation is the angle made with the horizontal by the axis of the piece. The alteration of tangent elevation begins to be appreciable with the high angle of sight required against aircraft. In the cosine law, used as a first approximation, the tangent elevation for the level is reduced by a factor, the cosine of the angle of sight, to obtain the elevation, firing at the same range, right up the line of sight to the airship. This law can be justified by supposing that the shell is actuated by gravity acting vertically downward and air resistance acting down the line of sight. This law will serve for practical use at a reasonable range, especially as the speed of target is of much greater importance than any second order correction of elevation. Aircraft guns should always be mounted in pairs so that the operators can have a check on each other and thus be sure of the ranges used and that they are both shooting at the same target. A simple case is that of a range of 2000 yards at a height of 3000 feet and an angle of 30 degrees. The angle of ordinary elevation in the range table for 2000 yards is, say, 2 degrees. Reduce this by the factor cos. 30 degrees to 1.7 degrees, and with this elevation a good trial shot will be made.

—Range-Finding

[Firing at Captive Balloons, and Some Aids for the Direction of Fire in Anti-Aircraft Firing. By Lieut. Allan Cyrus, Royal Swedish Coast Artillery. *Svensk Kustartilleritidskrift*, Part 1, '16. 1850 words. 4 illus.]

(A drawing and description of a "computing stick" for measuring distances to aircraft, and how to use it.)

[A German Method of Directing Anti-Aircraft Guns. *Sphere*, Nov 4, '16. 200 words. Illustrated.]

Anti-aircraft guns are located at the corners of a square or triangle. Ranging shots apparently fired with identical azimuths serve to establish a square or

ANTI-AIRCRAFT ARTILLERY—Continued

triangle in the air which forms a sort of "bracket" for the target. Corrections in the range and laying are then made to bring the projectiles on the target.

[Firing at Captive Balloons and Proposed Aids in Direction of Fire Against Aircraft. By Lt. Allan Cyrus, Royal (Swedish) Coast Artillery. *Jour U. S. Artill.*, July-Aug, '17. 2000 words.]

Objects in the air have shown themselves far from easy to hit owing to the difficulty of determining the elements of sight for the gun. In some cases captive balloons, tho subjected to fire, have been able to accomplish their work uninjured. In Germany a balloon was fired upon at a distance of 5000 m. with bursting shrapnel and was brought down only at the end of the series of 30 shots.

It is considered, however, that a balloon cannot remain up any length of time if it finds itself within 1.5 km. from an enemy's infantry; 5 km. from field artillery; and 6.5 km. from heavy artillery.

(Then follows a description of a computing stick used as an aid by a spotter in directing fire at balloons.)

ANTISEPTICS

See also
FLAVINE

APPROPRIATIONS

See
FINANCES, MILITARY

ARCHITECTURE, Military

See also
BARRACKS
HANGARS

ARGENTINA

See also
RAILROADS—ARGENTINA
RAILROADS—STRATEGIC—ARGENTINA

—Army

See also
ARGENTINA—MILITARY POLICY OF

—Army—Cavalry

See
CAVALRY—INSTRUCTION AND TRAINING—ARGENTINA
CAVALRY—ORGANIZATION—ARGENTINA

—Army—Infantry

See
INFANTRY—INSTRUCTION AND TRAINING—ARGENTINA

—Army—Organization

[Sixth Division of the Army (Patagonia). Necessity for Its Creation. By Captain F. S. Torres. *Rev. del Circulo Militar*, Feb, '17. 1750 words.]

Up to the present time Patagonia, comprising two-thirds of our territory and with a population largely foreign, has been without a single soldier to give needed protection to its inhabitants and to guarantee its future integrity.

It is time to put aside our lethargy and to compel ourselves to consider the problems which the future may have in store for us.

It is not from within that we need fear trouble, as the extent and richness of our soil will easily support twenty times our present population, but our growing wealth will tempt the cupidity of nations less favored and we must prepare to defend our land against invasion.

In carrying out the organic plan for the development of the army the sixth division should be located in the territory south of the Colorado river to Terra del Fuego: important centers should be garrisoned and new settlements located at places selected for their military value. Such communities, of military origin, would in time become sources of supply and strong points of support.

At the present time, owing to their isolation, lack of communication, etc., the settlements in Patagonia have become little nations within a nation. Owing to our neglect these people are establishing growing relations with Chile and our press is filled with denunciation of settlers who go to Chilean towns to have marriages legalized, births registered and business operations consummated.

Owing to her restricted territory Chile is incapable of sustaining ten millions of inhabitants. As her population increases two courses will be open to her: to send away her excess population or to extend her boundaries.

Her destiny toward the north is already fulfilled; who can doubt that she will maneuver to extend her territory to the south? The purpose of her ever growing fleet is only too plain and we cannot complain if she takes advantage of our indolence and neglect.

The maintenance of an army division in Patagonia will not greatly increase our national budget and the social and material advantages would be of incalculable value.

—Army—Reserve

[Observations on Military Districts. By Capt. Torres. *Revista Militar*, Nov, '16. 2600 words.]

The present war demonstrates the necessity of having in reserve trained men classified according to age, arm of service, profession, education, etc. The duty of providing these men falls upon the staffs of the military districts, who in this respect may be termed the vertebrae of the organism known as the general staff of the army.

The plan of mobilization worked out by the general staff is based upon the proper administration of the districts; this in itself evidences the importance of the functions entrusted to the officers on duty therein.

Officers serving with troops are prone to overlook the closeness of the connection between the army in being and the sources of its reinforcement in men and material. Orientation upon this theme is advisable for cadets in the third year at the Military College to enable them to know the *founts of resources* before

becoming masters of the *art of spending*. They should learn how men are recruited, trained, organized, and carried to the battle-field under conditions conducive to victory.

Service in military districts should be performed by officers on the active list and such details considered as honors. The districts should be given means to enforce the penalties imposed by law upon enrolled men who change their domiciles without due notification to the authorities.

Service in the reserve is for a period of nine years. In accordance with law an annual course of rifle practice has been formulated. Not ten reservists per thousand participate in this practice. Record books of the reservists pass thru the offices of the districts, which in this way keep in touch with them. Neglect of this important training is a menace to the security of the state. The military districts should be enabled to enforce its observance.

—Cavalry

See

CAVALRY—INSTRUCTION AND TRAINING—ARGENTINA

—History

See also

PARAGUAYAN WAR

SOUTH AMERICAN WARS OF INDEPENDENCE

[Military Conference. Some Interesting Themes. By Lt.-Col. García. *Revista Militar,* Nov, '16. 800 words.]

(In order to further interest in the collaboration of a military history of Argentina as well as to furnish subjects for professional study, Col. García presents some 34 themes which refer to historical instances of the use of fortifications in Argentine wars.

The following are given as examples: An examination of the defense organized by Alzaga after the battle of Miserere; the siege and capture of Montevideo by the Argentine army under Alvear; obstacles used during the war with Paraguay for the obstruction of water courses; examination of the plan of attack of the allied forces against Uruguayana.)

[An Unfortunate Night. By Ricardo Giménez, Lt.-Col. Ret. *Rev. del Círculo Militar,* Feb, '17. 1000 words.]

The headquarters of the central division operating in the desert was at Poitague; from this point expeditions were despatched to round up and subdue the hostile tribes.

Under pressure of light columns advancing in converging directions the Indians were gradually driven into their last strongholds in the deep recesses of the mountains (Andes).

A mixed force of 200 men including 25 friendly Indians and commanded by Lt.-Col. Rudecindo Roca, was assigned the mission of capturing the notorious leader Pincen reported to be intrenched in the range known as Cochi-Co.

The expedition moved south from Poitague and on the afternoon of the second day camped at Porto Hallado; the usual precautions against surprise were taken, guards were established, reserve horses were kept up (staked out near the camp), and the herd turned out to graze under herd guards.

During the night while all were sleeping the alarm was given that the Indians were stampeding the herd; as usual in such cases there was great excitement and confusion, many of the men only half awake leaped upon their horses, forgetting that they were tied, and driving in their spurs, both men and horses were overturned upon reaching the end of the lariat. Others, first to awake, dashed in among their sleeping comrades who were soon up and running in every direction.

After the first moments of confusion a small party, including the writer, started in pursuit; the Indians were overtaken about dawn, the herd recovered and two of the Indians taken prisoner.

Upon our return we were received by the Colonel and other officers and congratulated on our success, which had saved the command from a very embarrassing situation.

—Military Policy of

[Military Questions in the Congress. By Major Diana. *Rev. del Círculo Militar,* Jan, '17. 1200 words.]

During a discussion of the Army Bill at a recent session of the Chamber of Deputies, the views expressed by officers of the army in articles appearing in the *Revista* were effectively employed by Deputies who opposed the War Department recommendation relative to the period of service for the annual contingent.

Among other things it was said that in the past year the instruction had been given in six months without sacrificing any feature of the plan prepared for the entire year. As a matter of fact the recruits were not released in six months, thanks to the new government, which directed that they be held to the end of the year, but this fact was not, unfortunately, brought out in the discussion.

One Deputy quoted from the *Revista* the statement of an officer that in former years as a captain of a company and later as a major he had been able to give the necessary instruction in six months, and unfortunately there was no one to tell the Deputies that the conception of an army in those days was very different from that now held. It might also have been added that when compulsory service was first introduced it was deemed advisable to impose it little by little, fixing at first a minimum period of service with the colors. Such statements and others of similar nature confirm the belief that proper measures for the army cannot be secured until there is harmony of views among officers, and until their ideas can be presented in concrete form to the people.

An army requires that its elements of command should be cast in the same mold. Good intentions and sincere purposes are not sufficient. A large measure of common sense and a professional conception developed by experience, hard work and perseverance are also necessary in an officer. Where these attributes are lacking, it would be much better to keep quiet, observe and learn.

ARGENTINA—Continued

—Military Policy of—Compulsory Military Service

[A Propos of Some Suggestions on Obligatory Military Service. By Major Diana. *Rev. del. Circulo Militar,* Sept, '16. 2500 words.]

The most pressing question before our military authorities at the present time is "How to incorporate in the service the greatest number of the class which annually becomes available."

It has never been practicable in any country in time of peace to have all serve with colors, but all should receive some training.

That military service has been of benefit to those who thru the neglect of the state or parents have never had the benefit of a primary school education is no sufficient reason to limit the call to illiterates only. This would not only be unjust to them, but would prejudice the principal mission of the army, which is to insure the national safety by developing strong, well instructed, and partriotic soldiers.

To increase the number passing thru the ranks by reducing the period of service with the colors to six months would also be a great mistake, as the present term of one year is all too short for proper instruction, and would moreover double the expense.

Unfortunately there is much talk at the present time of the successful employment of troops in certain European armies that have had only three to six months of preliminary training, but it must be remembered that the war has now continued more than a year and that all of the belligerents are forced to the same expedient and these partly trained troops are not being opposed by thoroly trained and seasoned soldiers. No doubt in a long war we would also be compelled to use troops with little training, but to adopt the short period of service as a permanent system would be a grave error for which we would pay dearly. The proposition to limit the service with the colors to six months on condition that the recruit training had previously been completed in schools and colleges is equally at fault. The efficiency of an army depends on good individual instruction and requires thoro and careful recruit training, and this can never be satisfactorily given except in the army itself.

The question is most important and should be considered from all points of view. Discussion should be free and general so that our legislators may have the benefit of all opinions in framing the laws which so seriously affect the armed forces of the nation.

ARMAMENT

See
ARMOR

ARMOR

See
AUTOMOBILES—ARMORED
BALLISTICS—OF PENETRATION
FORTIFICATION—PERMANENT—ARMORED TURRETS
HELMETS—ARMORED

[The Struggle between Armor and Gun. By A. Milota. *Schweiz. Zeit. f. Art. u. Genie,* Jan and Feb, '16. 12,000 words. Illus.]

The successful attacks upon the permanent fortifications of Belgium, Poland and Northern France have again decided the struggle between gun and armor in favor of the former. Furthermore, the experiences of the present war prove that strong field fortifications, protected by strong obstacles, are able to withstand a protracted siege. After the fall of the Belgian forts, the French found themselves compelled to provide additional means of protection for the barrier forts along the western front. The decision was quickly made to remove all turrets and turret guns from the fortifications of Verdun, Toul and Belfort. The fixed and permanent works themselves were not occupied. The defense was now based upon a system of extensive field works, well concealed from both horizontal and aero observation. Most of the Russian forts were built on this principle. The fortress of Ossowiez is a classical example that a modern extensive field fortification, which offers no concentrated targets to the enemy, can absolutely neutralize the power and effect of the latest siege mortars and howitzers. The millions which France spent on her permanent fortifications were all for nothing. The hopes placed in the strongest fortified place in the world, Antwerp, were blasted by the wonderful progress made in the science of ordnance construction. The names of Krupp and Skoda have been written in bloody letters in the history of the war. The greatest ordnance triumph was the Austrian 42 cm. howitzer, firing an 850 kg. projectile, maximum range 15 km. It was employed for the first time in the forcing of the Dunajec.

Russia, Italy and France have failed to accomplish any decisive results in their attack of fortified places. As an example we have the failures against Cracow, Przemysl and the Austrian Tirolese barrier. In every case failure has been due to the superiority of Austrian armor to the opposing guns.

Most modern armored turrets for inland barrier forts are made of armor from 25 to 35 cm. in thickness. The surrounding concrete is from 2 to 2.5 m. in thickness. Nevertheless this mass was absolutely demolished by the large caliber mortars used by the Germans and Austrian. Considering the terrible effect of these modern heavy mortars, we must concede their overwhelming superiority over the most modern armored forts. They have reduced Ft. Loncin to a confused mass of twisted steel and broken concrete. Ft. Manonvillers, the most powerful individual work in the world, was reduced to ruins. At Loncin an armored cupola 250 mm. in thickness was completely perforated. At Longwy a shell pierced not only the armored cover but also went thru three floors of the casemates.

The experiences of the war will produce revolutionary changes in the construction of permanent fortifications. In place of concentrated and fixed forts of armor and concrete, we shall find extensive modern field fortifications with their movable armaments. With the appearance of the 42 cm. mortar, an armored turret is very much like a mouse-trap for its

personnel. Finally, nowadays war is nothing more than an application of all the technical sciences to the destruction of men and material.

[Note.—The remainder of this article is devoted to the history of armor and its manufacture; the use of armor in the construction of turrets; description and operation of the different types of gun turrets for coast and inland barrier forts; description of the distinctive types used in certain forts which the Central Powers have taken.]

—Manufacture of

United States

[Armor Plant to Charleston, W. Va. *Army & Navy Jour.*, Apr 14, '17. 550 words.]

Charleston, W. Va., has been chosen as the site for the $11,000,000 Government armor-plate plant for the following reasons: It is protected from invasive attack; it is the center of great coal fields, extensive natural gas fields and crude petroleum areas; basic pig iron is only 172 miles away, and "bessemer" about sixty miles; limestone and dolomites are available locally, and the freight cost is low on ferro-chrome, ferromanganese, and nickel. The Great Kanawha river affords water and water power. There are two trunk lines to the West and three to the East.

—Personal

See also

TACTICS (Article: "Modern Battle Tactics")

[The Danger in Steel Shields. Anonymous. *Schweiz. Zeit. f. Art. u. Genie*, Apr, '16. 200 words.]

(A transcript from *Schuss und Waffe*.)

In firing at a body shield taken from a captured Italian officer, it was found that it could be easily perforated at 100 m. by the Austrian rifle, the jagged edges of the perforation being 15 mm. in depth. Numerous splinters were found imbedded in the target.

ARMS

See

CAVALRY—ARMS
INFANTRY—ARMS

ARMY

See also

COAST DEFENSE—TROOPS
MARINES
MOBILE FORCES
OFFICERS
PROMOTION
STAFF

—Administration of

See

ADMINISTRATION, MILITARY

—Instruction and Training

See also

OFFICERS—QUALITIES OF

—Life and Service

See also

CLUBS, MILITARY

—Life of

See also

PENSIONS, MILITARY

—Organization

See also

AUSTRIA—ARMY—STAFF
RUSSIAN—ARMY—ORGANIZATION
SPAIN—ARMY—ORGANIZATION

[The Proportion of the Different Arms. By Lieut.-Col. F. J. Diaz, General Staff. *Mem. del Ejército* (Chile), Sept, '16. 4650 words.]

The proportion of the different arms has two different aspects: one which is purely organic and of great importance in the training of the officers, and the other of a tactical order, which deals with the action of the arms on the field of battle.

The organization of an army should normally be developed along lines securing the co-operation of all arms of the service, and with a tacit understanding of organizing and respecting the special and just conditions which each branch demands.

The organization of the Chilean army shows a preponderance of field artillery, which includes mountain and horse artillery. This favoritism has left the infantry in a deplorable state of affairs. Immediate steps should be taken to give the infantry, the principal branch of the army, its proper organization, and to hold the artillery to its proper proportion.

There are in Chile 16 skeleton regiments of infantry. For this amount of infantry there are 6 regiments of mountain artillery, 4 independent groups, equivalent to 2 regiments, and 1 horse battery. It is proposed to organize 2 additional regiments.

In time of peace, Germany generally has 2 regiments of artillery for every division; that is, 12 batteries for every 4 regiments of infantry; Argentine has 27 batteries for 80 companies of riflemen; Chile has 33 batteries for 66 companies of riflemen. France, with its 4-gun batteries, has 30 batteries or 3 artillery regiments for each army corps, which is the same as 15 batteries for each division; the Bulgarian divisions have 14 batteries for 32 companies; some of them have only 9 batteries. Each of the 6 Swiss divisions has 3 re-inforced brigades. In 4 of these divisions, the 3d brigade is intended for mountain warfare. Each division has 2 regiments of 6 batteries and 1 group of howitzers with 2 batteries. Each of the 4 brigades intended for mountain warfare has a group of 2 batteries. Summing up the above, we have 14 batteries for 54 companies of riflemen and 3 machine gun companies. In the case of the brigades for mountain warfare, the proportion of artillery is 16 batteries.

In France and in Italy, the existence of mountain artillery is due exclusively to the organization of Alpine troops.

Austria, Switzerland, Spain and Portugal are four countries which, in the organization of their fighting units, have made provisions for mountain warfare. In these countries, mountain artillery is assigned to special infantry units.

ARMY—Continued

Austria has army corps which are intended only for mountain warfare; take for example the XV (Sarajevo) and the XVI (Ragusa). Other corps have certain units designated for the same purpose, for example the III (Gratz) and the XIV (Innsbrück).

According to Balck's manual, edition of 1915, the proportion of mountain artillery is one battery for five battalions.

In Portugal, half of the artillery attached to the six divisions into which the army is organized, is composed of mountain artillery; this at the rate of one regiment per division, or a group per brigade.

In Spain, the organization is not so regular. Some of the army corps, like the VIII (Galicia) and the IX (Melilla) have nothing but mountain artillery.

Balck and Bronsart von Schellendorff state that 144 field pieces is the maximum to be assigned to an army corps.

Summing up, it can be stated:

1. That the proportion of mountain artillery in the Chilean army has far exceeded the ratio fixed by all other armies.
2. That this important arm, due to its present situation, is in great danger of lacking efficiency in time of war.
3. That the proportion of horse artillery and mountain artillery is not in accord with our past experiences, our probable theaters of war, or the organization of those armies which are similar to ours.

[Each One in His Place. By Lieut.-Colonel Osvaldo Amieva. *Rev. del Circulo Militar,* Sept, '16. 2500 words.]

The desire to appear wise and learned has become a mania in some armies, and even young officers just out of school pose as strategists and true military geniuses.

Frequently these self-styled strategists are unable to properly lead a platoon or perform the simplest duties of their rank, yet they discuss movements of army corps, plans of mobilization, etc.

Many of these ambitious ones have come to grief; some have betrayed the sacred secrets of their country for money and others have been exposed as impostors.

In some armies cliques of these ambitious ones exist close to the throne, they push themselves into high places regardless of their unfitness and the rights of others, and foist upon the army their half baked ideas.

Daily we see orders and counter orders, projects enacted into laws and laws repealed, all of which occasions injury to many innocent victims and a loss of prestige for the army.

Where such conditions are observed, it is the duty of those charged with governmental affairs to intervene and correct them with an iron hand.

Experience has shown that true success must rest on honor and merit and can only be acquired slowly and by hard work.

As a remedy for the evils of excessive ambition and for the establishment of a proper foundation for military advancement, it is recommended that each officer strive to fit himself in the highest degree for the duties of the grade in which he finds himself. The lieutenant should have at his finger tips all the regulations and duties of his office; the captain should be able to command and direct his unit in full accord with the regulations and tactical principles of his arm; he should serve as a model for his subalterns, remembering always that a good captain is the basis of a good general.

Regimental and brigade commanders should be able to direct the theoretical and practical instruction of their commands in field service, and all officers should be inspired to seek the best interests of the army as a whole rather than the personal fortunes of themselves or their friends.

[Divisional Organization. By H. B. F. *Military Historian and Economist,* Apr, '17. 4500 words.]

(The beginning of this discussion of organization by the same author appeared in the Apr 17 number under the heading: Company—Tactics. "Tactics and the Size of the Company.")

For the decisive attack in mobile warfare three echelons are needed behind the firing line: the first to maintain the firing line at full strength thruout the action; the second, to join the firing line at or just before the beginning of the assault and to participate in the same; the third, to relieve the badly mixed units after a successful assault and to protect them while they reorganize, to cover a counter-attack from the enemy, or in case of an unsuccessful assault to cover the retreat of our defeated forces. The addition of other lines would be a waste of man power.

However, in trench fighting every attack is frontal and the fronts must be narrowed and depth increased so that line after line can be thrown at the enemy. But since trench warfare will not occur in the United States our organization should be fitted to the needs of open, mobile warfare. In the attack we need: a firing line, a line of supports and two lines of reserves. The proposed company of 250 men will furnish the firing line and supports; the attacking battalions (usually two to a regiment) the first line of reserves; and the regiments the second line of reserves.

Thus, with the company large enough to fight in two lines, the necessity for an echelon from the brigade disappears, and with three regiments in the brigade they should be fought abreast instead of having two in the line and one in reserve. The brigadier could command this front of about 2000 yards but with nine large infantry regiments and properly proportioned artillery the divisional road space would be too great and its ultimate deployment beyond its usually required task. Therefore, since the division should consist of three infantry brigades, the brigade should consist of only two regiments. The three-brigade division is tactically better, both for offense and defense, than one with only two brigades. The infantry division should contain three brigades of two regiments each making six regiments or eighteen battalions, a total strength of 18,000 men. In arriving at this effective total the auxiliary organizations are not considered, since they do not affect the front in deployment.

Four guns per 1000 infantry effectives is thought to be the ratio that best meets the complicated questions or organization, road space, deployment, etc. This would provide 72 pieces for a division.

After considering the need for other auxiliary units the following is given as a proposed complete division:

Three infantry brigades, each of two regiments,

One artillery brigade containing 72 guns and howitzers,

One regiment of cavalry,

One company of pioneers,

One battalion (2 companies) of signal troops,

One aero squadron,

One battalion of mounted police, and

The trains.

This large company and division organization would satisfactorily meet the requirements of American conditions and terrain and would fit in nicely with the whole land defense scheme of the United States.

(There follows an able discussion of the best method of raising troops, training them and returning them to the reserve. The author closes his article with the observation that quality in troop leading and in the character of the troops, and not numbers, win to-day as always in the war of maneuver, and that this can be obtained only with large units and considerable periods for training and discipline.)

—Organization—Swiss System

See also

SWITZERLAND—ARMY

—Pay

See

PAY, ARMY

ARRAS, Battle of

[The Battle of Arras. By Hilaire Belloc. *Land and Water,* Apr 12, '17. 2600 words. 2 sketches.]

It is a matter of common knowledge that the Vimy Ridge has been regarded by the enemy thruout the war as one of the capital points upon his entire line. This position has been at once the main objective of three great Allied movements made with the object of seizing it and the main test in the enemy's mind of his power to hold. He has attached to it a value and measured that value in an expense of men not paralleled upon any other point between the North Sea and the Alps.

The first great attack was made in the spring of 1915; the second, coincident with the English attack at Loos and the French attack in Champagne, was made in the autumn of 1915. The present struggle serves to emphasize the high value which both sides have set on this piece of ground.

The strategical value of the Vimy Ridge lies in the three following points: It is of chalk and the last bit of chalk for a long way; it is exceedingly valuable for observation, and the last piece of abrupt high ground of the sort for several days march; and it is the one piece of strong ground defending the northern pivot of the new line which the Germans are attempting to hold.

The fact that the wall of hills is of chalk means that it is dry, very easily worked for profound defensive formations, with very warm, well drained dug-outs, etc., and drained at once everywhere by nature. The only drawback of field works upon this sort of formation is the conspicuous way in which the trenches stand out in white against the general soil. However, this is of less importance now than it was before photography from the air was originated by the Allies.

Observation is of still more importance. The value of direct observation in this war has been perpetually insisted on and is now of common knowledge. But the last point is by far the most important of all. The Vimy Ridge, if it be retained and used as a line from which further extension can be made, is vital to the northern junction-link upon the holding of which the security of the Arras-St. Quentin-Laon line depends. So long as the enemy held Vimy Ridge progress to the south of it along the great roads from Arras to Cambrai and Douai was impossible. Progress along these two lines would ultimately bring the great trunk railway line, St. Quentin, Cambria, Douai, Lille under fire, and it would immediately create a sharp flank on the line south of Arras and compel its abandonment. The point is in every sense critical, and a successful attack upon it would be locally decisive. It would compel a general retreat. It must be remembered that success or failure is less to be judged by contours and ground than by material and morale. It is a siege war. It depends upon destroying and advancing over works which, tho called field works, are much stronger under modern conditions than the old permanent works of the past. The power to destroy them and to advance over them depends entirely upon these two factors: the moral value of the infantry as compared with the enemy's, and the mechanical superiority given by the present prodigious output of munitions and pieces. For two years the Allies lacked the required superiority in material, tho the moral superiority was assured. The enemy's superiority in matériel, which was his greatest asset, no longer exists.

ARROWS, Aero

See

"FLECHETTES"

ARTILLERY

See also

AERIAL ARTILLERY
ANTI-AIRCRAFT ARTILLERY
COAST ARTILLERY
FIELD ARTILLERY
MACHINE GUNS
MOUNTAIN ARTILLERY
SIEGE ARTILLERY

Great Britain

[Production of Artillery in England. *Memorial de Ingenieros del Ejército,* Apr, '17. 200 words.]

ARTILLERY—Continued

The production of artillery in England has increased at the following rate:

Production in the first year of the war:
Field guns of small caliber, 100.
Field guns of 10.5 cm., 100.
Mortars of 15 cm., 100.
Cannon of large caliber, 100.

Production in the second year of the war:
Field guns of small caliber, 240.
Field guns of 10.5 cm., 654.
Mortars of 15 cm., 1848.
Cannon of large caliber, 623.

Production since the 1st of August, 1916, to Nov 23 of the same year:
Field guns of small caliber, 45.
Field guns of 10.5 cm., 104.
Mortars of 15 cm., 1200.
Cannon of large caliber, 363.

The production of machine guns has likewise increased. In the second year of the war there were 12½ times as many produced as in the first, and in the first four months of the third year, 420 times as many.

The increase in the manufacture of explosives has been even more rapid. The production increased 350 times in the first year and 11,000 times in the second.

—Combat

See also
MACHINE-GUN—FIELD USE OF

—Erosion and Life of

[Erosion in Guns and Their Life. Anonymous. *Schweiz. Zeit. f. Art. u. Genie,* Apr, '16.]

(A technical discussion of the causes and effects of erosion based upon experiments carried out in England, Germany, United States, and Norway. The basis of the article is a discussion of the same subject by First Lieut. Harold Hausen in the *Norsk Artilleri Tidsskrift.*) The following points are emphasized:

The life of desired accuracy of a field gun is 4000 shots; of a 21-cm. gun, 400 shots; of a 30.5-cm. gun, 150 shots. Altho it is possible to measure the amount of erosion and wear, it is very difficult to determine how much of this is due to such different causes as corrosion, cleaning, rotating band, oscillations of the projectile, elongations and contractions of the tube, deformation of the lands, heat generated by the powder gases, variations in the diameter of the bore due to firing stresses, character of the steel used in gun forgings, pressure of the powder gases, method of construction whether built up or wire wound, etc. The English have hesitated to use specially hardened steel for their gun tubes for fear of erosion. The Germans use a steel with 6% nickel for their tubes. In the naval battle of Aug 10, 1905, the Japanese had seven wire-wound guns destroyed by premature bursts in the tube, undoubtedly caused by constrictions in the diameter of the bore resulting from firing stresses.

An increase in the size of the rotating band is of little advantage to prevent erosion, because the powder gases have little opportunity to escape between the band and the walls of the tube. Powder erosion manifests itself principally in the front part of the chamber, in the forcing cone at the beginning of the rifling, in the vent for the firing pin or firing mechanism, and on the end of the firing pin.

In the United States many experiments have been conducted to reduce erosion in large guns. A special construction of the land and the rotating bands has been tried, also certain variations in the twist of the rifling. Extensive tests have shown that the chief cause of erosion is the high temperatures and pressures resulting from large propelling charges and high initial velocities. For instance, in the 15 cm. gun 254 shots fired with an initial velocity of 850 m/s. give practically the same erosion as 1198 shots fired with an initial velocity of 700 m/s.

In order to reduce the temperature of explosion in nitro-glycerine powders, a chemical compound rich in carbon is added. For cordite this is 5% of vaseline; for ballistite it is 8% nitro-naphthalene. This latter compound is, however, the principal cause of the flash at the muzzle. Capt. Jones of the U. S. Navy has stated that with nitro-cellulose powders the erosion in the 30.5-cm. gun produced by one full service charge is equal to that produced by two ¾ charges or six ½ charges. With the 15-cm. gun the proportions are even greater, or one, three and twelve. In recent years the United States has experienced many premature explosions, the cause of which is believed to be due to stresses and flaws in the forgings produced by overheating when the gun is built up. The cause may, however, be in the use to which these guns are put every year in their target practice. The ammunition allowance for 30.5 guns is 20 rounds annually. In England the allowance is only 16 for the same guns, and even then some of these are fired with reduced charges. Other nations have still a smaller allowance. The large ammunition allowance is permissible in countries that are able to renew their guns even in time of war. It will not do for small nations.

[A Method of Relining Guns Worn Out by Erosion. Anonymous. *Schweiz. Zeit. f. Art. u. Genie,* July, '16. 750 words.]

The bore is first made chemically clean by applying a hot solution of soap and sal soda. The inside of the bore is then roughened by a sand blast and again cleaned. After this the lands and grooves are covered with a molten metal applied under high pressure by a patented apparatus.

[Erosion of Guns—The Hardening of the Surface. By Henry Fay. Reprinted from *Transactions of the American Institute of Mining Engineers* by *Jour. U. S. Art.,* May-June, '17. 4500 words. 14 illustrations.]

(A complete abstract of this paper is impossible without reproduction of the diagrams.)

The particular phase of the problem presented here is the hardening of the inner surface of the gun tube. It is known that after being fired for some time, the surface of the bore of a large caliber gun becomes hard and brittle, cracks, and wears away. This action takes place in smaller guns also, but is accelerated with the increase in the weight of the projectile.

To investigate these phenomena, a 12-inch gun was trepanned and rings representing various sections of the gun were cut out for examination. The greatest amount of wear, and maximum amount of hard surface layer were found in the section nearest the powder chamber. The depth of heat crack varied irregularly. Four of the sections showed a hard layer on the surface cut normal to the axis. The cracks are undoubtedly due to the unequal expansion and contraction between the hard and soft layers.

Hardening may be produced by three well defined methods: 1° cementation; 2° heat treatment; 3° mechanical deformation or cold work. The principal products of the combustion of the powder are carbon dioxide, carbon monoxide, water and nitrogen. It is conceivable that large amounts of the monoxide are formed, and this substance is known to be an ideal carbonizer.

When a piece of steel is heated above its critical temperature, and then suddenly quenched, it is hardened. The temperature of combustion of the powder is sufficiently high to heat the skin of the metal above the critical point, and hardness would follow if the surface were then to cool with sufficient rapidity. The relatively low temperature of the large mass of steel would produce a rapid loss of heat. Mechanical deformation produces hardness and brittleness, and even cracking. The mechanism of this action seems to be that a surface skin is built up by mechanical movement which gives unmistakable evidence that the surface must have passed thru a state in which it possessed the perfect mobility of a liquid. The surface so produced has properties differentiating it from the surface underneath.

Whether the hard gun surface is due to cementation is not yet settled. That hardness may be due to the rise of the temperature above the critical point is certainly possible. But such hardening ought to produce martensite, and this substance in its characteristic needle-like form is never found, altho troostite is frequently found. It seems to be clear that the hard surface is composed of martensitic material. That mechanical deformation has much to do with developing hardness is shown by the selective hardening on the driving edge of the lands of the muzzle section, and by some experiments made on pressure plugs.

"Knowing that pressure plugs harden in the same way as the surface of the gun tube itself, it was decided to experiment with pressure plugs, and to follow the development of the hard surface layer in its various phases. For this purpose, a plug having approximately the same composition as gun steel was prepared for service. The metal was carefully analyzed, it was heat treated, and photographs were made of the fine sorbitic structure. The surface as a whole was uniform. The prescribed lettering was stamped on the surface. It was then placed in service, and after having been fired until it showed signs of heat cracking, was returned for microscopical examination. The face was polished and etched, and the structure seemed to be normal, but it was seen on detailed examination that the hard surface had begun to appear on the edge of the center hole and on some of the letters. Examination showed that this development had taken place at those points where the *maximum amount of cold work had been applied in stamping the letters*."

[Details based on an examination of the diagrams are necessarily omitted here], but the evidence seemed to support the "view that cold work was an important factor in the martensitization of the metal."

Further experiments on pressure plugs (for details see original) seem to prove that the hardness of the surface of a gun tube is due to a combination of mechanical deformation and a process of martensitization. This process takes time: heat cracks appeared before the change of structure had taken place. When the structure first changes it appears as troostite, which develops into amorphous martensite. Why a cold-worked metal is more susceptible to the sorbite-troostite-martensite change when exposed to firing, is not clear. But it has been shown that mechanical deformation of any kind produces an amorphous state in the metal, and it is possible that amorphous metal may have a greater solvent power for iron carbide. It has further been shown that certain reactions ordinarily taking place under the action of heat can be made to take place at ordinary temperatures when under pressure. Now in the gun the original metal is sorbitic, and the iron carbide is therefore chiefly in the free form. When subjected to the pressure of cold work, or to that of explosion at high temperature, solution may take place, and thus lead to the formation first of troostite, and next of martensite. Either hypothesis—solution in amorphous metal or solution by pressure—may explain the phenomena observed, but the latter is the more likely.

—Fire

[Drum Fire and Temperature of the Air. Anonymous. *Schweiz. Zeit. f. Art. u. Genie*, May, '16. 300 words.]

(A discussion whether artillery fire has any meteorologic effect upon the weather.)

[The Cause of Premature Explosions in the Gun. *Schweiz. Zeit. f. Art. u. Genie*, Aug, '16. 1000 words.]

(Transcript from *Prometheus.*)

Premature explosions are held to be due to small contractions in the bore near the point opposite the front end of the jacket. The projectile in forcing its way thru the bore has a tendency to take the metal of the bore with it. The initial compression of that part of the tube enclosed by the jacket resists this, whereas the part of the tube in front of the jacket has greater elasticity. The result is a small contraction in the diameter of the bore at the indicated point.

ARTILLERY—Continued
—Fire—Audibility of

[The Reason for the Double Report in Gun Fire. H. Bacleses, C. E. *Schweiz. Zeit. f. Art. u. Genie*, Jan, '16. 1000 words.]

(This is an extract from the original article by the author appearing in *Schuss u. Waffe*. It explains the reason for the double report heard in gun fire, that is, difference in the velocity of the projectile and of the sound of explosion at discharge. The phenomena of sound and audibility in the case of whistling, detonation and explosion are then discussed.)

[The Audibility of Gun Fire. Anonymous. *Schweiz. Zeit. f. Art. u. Genie*, May and June, '16. 11,000 words.]

[Note.—This article is a review of several articles on this subject which have appeared in *Artill. Monatshefte, Schuss und Waffe*, and *Zeit. f. d. ges. Schiess u. Sprengstoffwesen*.]

In Switzerland, since the outbreak of the present war, many unusual observations have been made concerning the audibility of gun fire. History records many such unusual circumstances. At Liegnitz in Aug, 1760, Generals Daun and Lascy failed to give the proper support because neither one had heard any firing. In 1866 the Prussians lost the fight at Trautenau because the Guard Division had failed to hear the sound of the guns. Here there was an intervening wooded ridge. For the same reason the 13th Prussian Division failed to give any support at Spicheren in Aug, 1870. In many cases the zone of silence was due to the topography of the country. The great powder explosion near Vienna in 1912 showed a zone of silence between 200 and 300 km. from the source. The same phenomenon was observed in 1809 at Hanover during the bombardment of Heligoland; also in Austria during the battle of Leipzig in 1813; in southern Germany during the siege of Antwerp in 1832, and recently on many occasions in Alsace and Lorraine. In all of the foregoing cases the phenomenon was due to a combination of geography, meteorology, and topographic conditions.

In order to explain this phenomenon, it is necessary to understand the laws of wave motion, especially those affecting interference, acoustic shadows and the phenomena of sound reflection due to clouds or certain acoustic strata.

The zones of silence are generally explained by interference due to two dissynchronous sound waves, one of which travels horizontally from the source while the other is reflected from an acoustic cloud or strata, thus following a longer path. Other investigators explain the phenomenon by temperature and wind refractions.

The triple report sometimes noted during gun fire is due to the report of explosion, the displacement of air resulting from the high velocity of the projectile, and finally the burst on impact.

In the following table are given the places, distance at which sound was heard, cause of explosion and year. These represent the greatest distances at which this phenomenon has been observed:

Island of Rodriguez from Krakatau...	4775 km.	Volcanic explosion.	1883
Heilbronn, Germany, to Belgrade	970 km.	Gun fire.	1915
Saxon Erzgebirger from Antwerp ...	590 km.	Gun fire.	1832
Tribson, Pomerania, from Tannenberg.	450 km.	Gun fire.	1914
Sadnigkopf (Kärnten) from Gislikon	350 km.	Gun fire.	1847
Ziegenhain, Germany, from Verdun	338 km.	Gun fire.	1916
Godalming, Surrey, England, from Maubeuge	332 km.	Gun fire.	1914

[The Detonation of Shells and Bullets. By Charles Nordmann. *Revue des Deux Mondes*, Oct 1, '16. 4600 words.]

Certain facts pertaining to the detonation of projectiles deserve careful attention. A knowledge of them may be of use in saving lives, and will certainly tend to decrease errors on the part of those whose business it may become in war to locate hostile batteries or rifles by means of their noises.

It is known that often even if one had instruments sufficiently accurate to determine exactly the direction from which the sound of a cannon shot came, the information so obtained would in no wise indicate the direction of the gun itself.

Often on the target range where infantry is firing, an observer placed behind the targets will simultaneously hear the detonation and the impact of the bullet against the target; as if the sound had traveled as fast as the projectile, which is known to have traveled faster than sound.

It has been determined that the sound of the explosion or initial detonation does not in such cases disappear, nor depart from its historic rate of speed of 1100 feet per second, and that, altho diminished in volume, it makes itself heard a certain period of time after the noise of the high speed detonation previously mentioned, and which has been designated as the *crack* of the projectile.

It was Mach who elucidated exactly the nature of the phenomenon; and consequently, the peculiar waves that produce the crack of the projectile are frequently referred to as the Mach waves.

An illustration will serve to explain the production of this sound. When a vessel advances over a calm sea its bow traces a long double furrow formed by two straight lines diverging along the vessel, but meeting at its bow. The Mach wave is a wave similarly formed in the air by the violent shock of the projectile. By forcibly striking the successive elements of calm air encountered in its trajectory, the projectile causes a condensation, a sort of pointed and divergent air disturbance forming a cone, of which the apex is occupied by the point of the projectile, and which it carries along with it thru the air at its own rate of speed.

When a small boat is a short distance to the right or left of a vessel moving over a calm sea, it feels a slight splash at the moment it meets the angular furrow from the vessel's bow. Similarly when the condensed conical wave, which the high-velocity projectile carries with it, meets the ear of an observer, he hears a sound (for a sound wave is only a condensation followed by a rarefaction of the air); he hears the crack of the projectile, and it is a moment later that he hears the initial detonation, which formerly was wrongly confounded with the crack.

Experience has also shown that the shell or bullet produces this crack only when its velocity is greater than that of sound.

Many pieces—all mortars, all short cannon, a good many howitzers, and all trench cannon—discharge their projectiles with a low initial velocity inferior to that of sound. For all these guns the phenomenon of the crack does not exist, and one hears only the detonation of the discharge. With the long cannon of great initial velocity, one may, on the contrary, hear two sounds, and this fact leads to various curious consequences. These Mach waves, called also *shock waves* (because they are caused by the shock of the projectile against the air), have been photographed, and are thus revealed as resembling the liquid cushion formed against piles by a rapid current. They are indeed formed in an analogous fashion.

The fact that shells of low velocity produce only a single detonation, which is propogated in the air at the rate of 1100 feet per second, permits one to take warning of the coming of these projectiles a certain time before their arrival. Assuming that the projectile will fall near the observer, the interval between the instant when he hears the sound of the discharge and that of the projectile's arrival, varies directly with the distance of the gun and inversely with the initial velocity. As an example, in the case of the old 15 centimeter German howitzer, with the initial velocity of 245 meters per second, the shell, when fired from a distance of 1500 meters, reaches the point of fall 2 seconds after the sound of the discharge; fired from a distance of 5400 meters, the shell arrives 27 seconds after the sound of the discharge.

There is, then, in many cases plenty of time to take shelter. One is warned, moreover, not only by the detonation, but also by the whistling produced in the air. The whistling is due to the friction of the projectile against the atmosphere, as it rotates and balances itself; moreover, an important cause of the whistling of the shell seems to be its meeting in the air with the discontinuities (condensations and hollows) caused by the sound waves which have preceded it from the detonation of discharge.

On the other hand, high-velocity projectiles travel much faster than the sound waves. It follows that, for those, near their point of fall, there is no warning either from the detonation of discharge or from whistling. These projectiles are therefore much more dreaded by the soldiers.

This, however, applies to these high power projectiles only in the first part of their path, in which their velocity is greater than that of sound. As the range increases the speed decreases and a moment comes when the projectile travels more slowly than sound. The sound waves of the detonation of discharge therefore begin to catch up with the shock wave; at a point of the trajectory, in long range firing, they overtake it, and from there on, if the flight of the projectile continues, the latter is preceded to its point of fall by the noise of the discharge of the gun and by the warning whistling.

These phenomena bring about some peculiar consequences. First, beyond a certain distance the noise of the discharge becomes so enfeebled that one frequently hears only the crack of the projectile.

When the ear receives the shock wave (Mach wave) it naturally tends to refer the origin of that sound to a direction perpendicular to that of the front of the wave as it strikes the ear. It is clear that the latter direction differs greatly from that of the gun itself. In other words, the direction from which the sound appears to proceed, is in no wise that from which the shot was fired. From this, illusions and errors frequently arise in campaign. If one hears a detonation in front of oneself, there is nothing to prove that it comes from a gun located in that direction. In a trench, all the occupants and observers, except such as are directly in the line of fire, will hear the detonation of a shell from varying and misleading directions.

Certain meteorological and astronomical phenomena have light thrown upon them by the knowledge gained in regard to the crack of projectiles. For example, upon the occasion of the falling of "fire balls" or meteors, spectators widely separated have stated that they heard the ball explode with a loud noise directly over their heads. Now it could not explode over the head of each spectator, some of whom are miles apart; in some cases also the meteor has been found intact embedded in the soil, with no trace of its having exploded. The meteor, which had penetrated our atmosphere at a speed vastly superior to that of sound waves, had produced in it an energetic Mach wave, and it was that, which so violently struck the ears of the observers, and caused them to believe they had heard a formidable explosion over their heads.

[The phenomena discussed above have long been well-known; they have been mathematically investigated by General Fernand Gossot, of the French Colonial Artillery, who turned the "shock" wave to account by making it actuate a recording apparatus for proving-ground work in the determination of velocities. A translation of his paper will be found in the *Journal of the U. S. Artillery,* Vol. I.—Ed.]

—Fire—Long Range

[Long Range Artillery. *Army & Navy Gazette,* Oct 27, '17. 1000 words.]

The war has proved the need of massing guns, and has disproved the theory that one quick-firing gun was likely to do the work of two guns. None of the combatants except the Germans foresaw that heavy ma-

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tériel would be so largely used. But even the greatest enthusiasts do not appear to have contemplated the present concentrations of artillery.

The Germans are said to have established a proportion of five to six between their heavy and field artillery, the former including many long range guns.

In the offensive the chief difficulty seems to be in consolidating captured positions and then getting heavy guns to the front to cover a fresh advance before the enemy has had time to establish himself on a new line. This difficulty can be overcome in only two ways; either by increasing the range of the guns employed or by acclerating their means of transport. The latter method presents mechanical difficulties that may be found impossible to overcome. The former, however, we know to be feasible. It only remains to devise a means by which long range matériel can be employed with the best results. When the enemy retreats he moves his heavy pieces first and establishes them in new positions out of range of our guns. The action is then brought to a standstill in important movements until the attacking artillery can be moved to new positions. Thus, the first success cannot be immediately pursued. If, however, the range of the attacking guns should be greatly increased, they could cover the infantry in a continuous advance to a much greater depth. Thus, the long range gun has its advantages when used for counter-battery work. It can also take the place of the ordinary matériel when circumstances demand it.

—Fire—High Angle

[Notes on High Angle Fire. By Harold C. Clausen, M. I. J. E. *Jour. Royal Artillery,* July, '16. 2000 words. 5 figs.]

The usual method of making up a high angle range table by calculating the trajectory in steps, or arcs, is a long and tedious one, and the results arrived at by this process have to be altered slightly, since at the angle of sight equal to nothing they do not generally agree with the ordinary range table along the ground. Therefore, these results cannot be taken as quite accurate. The method of utilizing equations obtained when firing in a vacuum together with the ordinary range table along the ground give results very closely agreeing with those of the arc method and take much less time.

Equations are deduced showing the various elements of the range table by the tangent method, and examples are given to illustrate the application.

The conclusion arrived at is that all modern rifles and guns, when fired near the vertical, will reach the maximum height attained by aircraft under service conditions, but what is of real importance is that the time of flight should be as short as possible, hence the need for high velocity anti-aircraft guns.

[Curved Fire Field Pieces: Their Influence and Use in Modern Combat. By Capt. Gmo. Novoa, General Staff. *Mem. Del Ejército* (Chile), Dec, '16. 6000 words.]

The writer discusses the subject under five different headings:

I. What is understood by curved fire field pieces. II. Heavy field artillery in the past. III. Organization of the heavy field artillery in the principal armies. IV. Governing principles as to the use of light and heavy howitzers. V. Influence and rôle of curved fire field pieces during the present war.

Some authors claim that there is no reason for the difference of designation as regards mortars and howitzers. This difference was necessary when smoothbore pieces were in existence. Then, those under 2½ calibers were known as mortars; those from 6 to 8 as howitzers; and from 11 to 12, short cannon. The Krupp factory does not use the term mortars. All curved fire field pieces are known as howitzers. The German artillery designates under the name of mortar only the 21 cm. pieces.

Frederick II was the first one to organize and use what is now known as heavy field artillery.

In France, Gen. Gribeauval was the first one to establish the distinction between matériel intended for field operations and that intended for siege operations.

Heavy artillery was practically not used in the wars of the Revolution and of the Empire. It appeared again during the war of 1870. It is well to note the use made by Gen. Werder of 18 pieces of heavy caliber during the siege of Belfort.

After the war of 1870, France having fortified the regions of Verdun, Toul and Epinal, the Germans organized batteries composed of 15 cm. howitzers and of 21 cm. mortars. This artillery was attached to the field armies.

The heavy field artillery justified its employment in Manchuria.

It is well to mention that the results obtained during the Russo-Japanese war from the use of curved fire field pieces did not justify the enormous expense of ammunition; even so, however, no unfavorable conclusions should be drawn from these results. Since then much progress has been made in the matter of observation of fire, methods of laying, and use of aviators, a great factor in the employment of artillery, especially heavy field artillery.

Following the German doctrine, Chile has adopted a 10.5 cm. howitzer as an integral part of her field artillery equipment. Before the present war France had not adopted a light howitzer for the field armies. The 75 mm. and 155 mm. Rimailho were the only artillery matériel. Of the latter only four pieces were attached to an army corps. This was because the French were of the opinion that the 75's were sufficient to handle all possible conditions. Also, they counted on maneuvering to win the battles.

In order that the heavy field artillery may support the infantry, it is necessary that the first mission of the former be that of engaging the enemy's artillery. The field artillery proper should look after the enemy's infantry.

In 1907 a French military commission made the following report:

"The employment of heavy field artillery against field intrenchments would be a great error. The artillery can only demolish field works, and this after an excessive use of ammunition. It is necessary to use shrapnel against the defenders of said field works; therefore the 75 is sufficient."

The present trench warfare has shown the fallacy of the French theory.

Mr. Charles Humbert, Vice-President of the Senate Military Committee, has published an article in which he states that when the French infantry assumes the offensive it will be necessary to have a number of cannon of heavy caliber, ten times superior to what is now being used. Let us take the German viewpoint. Gen. v. Richter states that according to the statements of combatants and of newspaper correspondents it appears that in the present war the artillery has played an entirely different rôle from that played in the Russo-Japanese war. In this war the field pieces and light howitzers are found side by side with the heavy field artillery. Henry Carby, who witnessed the operations of the Serbian army, in an article headed, "The Defeat of Serbia by Cannon," states the following:

"Economizing a human material which is daily becoming scarcer in Germany and Austria, Gen. von Mackensen has obtained such wonderful results, thanks to a formidable industrial matériel, thanks to the heavy caliber cannon and thanks to the very large supply of artillery and of ammunition."

The proportion of curved fire pieces and of field pieces has not been determined. Some claim that it should be two-thirds. It seems that one-half is the right proportion.

Before the European war there existed two well-defined theories regarding the rôle of the curved fire field pieces on the battle-field.

The French depended a great deal on the great efficacy of their 75's. When the Germans converted their 7.7 cm. into a rapid fire piece, the 75 found a worthy and equal adversary. At the same time Germany was developing the use of the heavy field artillery in connection with the field armies. There was a big clamor in France, in which the adoption of some curved fire field pieces was demanded. The introduction of the 156, Rimailho model, only partially filled the requirement, on account of the limited number recommended. The curved fire field pieces accompanying the mobile forces, which at the beginning were considered as a special arm to be used by the mobile forces in sweeping away the strong obstacles stopping their advance, have now the task of compensating the defects of field artillery when fortified positions are encountered. In order to overcome the resistance offered by intrenchments, natural or artificial, it has become necessary to resort to curved fire and to adopt the logical conclusion of attaching heavy field artillery to all mobile forces, and to use it in the same manner as the other arms.

—Instruction and Training

[Preparation of the Artillery for War. By Marcial Urrutia, Captain at the War College. *Mem. del Ejército* (Chile) Oct, '16. 4000 words.]

The writer, in discussing the subject of preparation of war, considers that the establishment and organization of the following agencies is a matter of great importance for the Chilean Army:

1st. A school of fire for field artillery.

2nd. A technical school for artillery and engineers, where officers of all branches of the service would receive instruction in the matter of testing, constructing, preserving, and inspecting ordnance material of every description.

3rd. A school for mechanics and saddlers.

4th. Ammunition and powder factories. In Brazil and Argentine the Government owns ammunition factories. Chile has to purchase from abroad.

Closely connected with this study is the development of the mobilization of industrial resources. A modern army, which is anxious to be prepared for war, has to perfect in time of peace a plan for the mobilization of the industrial resources of the country. The great resisting power of Germany is due to the fact that she has not been compelled to procure a single thing from foreign countries.

—Manufacture of

See
ORDNANCE

—Tactics

See also
TACTICS (Article: "Modern Battle Tactics")

[Faulty Conceptions of Artillery and Tactics. Anonymous. *Schweiz. Zeit. f. Art. u. Genie,* Aug, '16. 4500 words.]

Protracted periods of peace are not always favorable to progress in military development or the art of war. An army is very likely to become indoctrinated with incorrect principles. Things of insignificant importance or having, in fact, no influence upon war are easily exaggerated and given a disproportionate amount of valuable time or are ascribed too much importance. In his book "Military History of Germany in the 19th Century" the late Field Marshal Von der Goltz, of the German army, points out the evil effect of false military doctrines in a most convincing manner. He shows to what extravagant excesses the officers of the Prussian army had carried the supposed teachings of Frederick the Great and in what blundering manner they had developed in the years of peace immediately following the Seven Years' War the real and earnest lessons learned on the battlefield. After a protracted period of peace it is difficult to judge in an unprejudiced manner the underlying conditions which spell success in war. Drill and ceremony, sham and artificiality, display and appearance, are exalted to a position of primary importance. Such a thing as leadership in the higher grades of the Prussian army, or resourcefulness in the lower, was absolutely wanting. The wars in Flanders in 1787 added new lustre to the reputation of the Duke of Brunswick. The campaign in France which ended with the battle of Valmy made the old army rather doubtful of itself. The campaigns of 1793 and 1794 brought small successes but presaged Prussia's military decline. But these sham successes did more harm than good, for they merely postponed

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the day of judgment for 12 years. The capitulation of Ulm and the defeat at Austerlitz were the warning of the final breakup, but it was too late. Jena came the next year, and with it the fall of Prussia. The line tactics of Frederick the Great had fallen before the column tactics of Napoleon.

Altho Frederick the Great had not done much for the artillery, he did introduce the artillery preparation and the use of artillery masses. Under Napoleon these were still further developed, especially in the decisive attack. To accompany this attack the mobility of the artillery had to be increased. The field mortars and howitzers, which even in the times of Frederick formed part of the field army, disappeared because of lack of mobility, not to reappear again until modern times. The wars of the French Revolution produced a complete transformation in the methods and means of conducting war. It made the armies complete in all their parts and encouraged all leaders from the highest to the lowest to practice initiative and be resourceful. (To be continued.)

—Tactics—Co-operation with Infantry

See also

ARTILLERY—FIRE—LONG RANGE
INFANTRY—TACTICS—CO-OPERATION WITH ARTILLERY

—Uniforms

See

UNIFORMS—FOR ARTILLERY

—Use of in European War

[Artillery Paramount. From *Impressions of a Combatant.* By Charles Nordmann. *Revue des Deux Mondes,* 15 Nov, '16. 17,200 words.]

"Experience," said Henri Poincaré, "is alone the source of truth."

Previous lessons and all the teachings of books and systems çount for but little beside the great and glorious lesson which began Aug 1, 1914.

It has been often said and written that this war of trenches was a novelty, and that it had never been seen except in siege operations, never in the open country. Nothing is more routine, however, and to be convinced, one has but to study all the recent wars; they reveal the evolutions of the defensive in open country in this same sense.

But this fundamental rôle of field fortifications, which had been somewhat neglected with us, had in reality been long ago put in evidence by the old masters of bygone days, notably by our own fine military genius, Vauban.

The latter is generally considered as an authority as to everything connected with the attack and defense of fortified places, but it is too little known that this great builder of fortresses held views not less astonishing on the question of war in open country. We have found in some of his unpublished works, to which attention was called by Colonel de Rochas, some precepts which, after the lapse of two centuries, throw light that is peculiarly illuminating upon present-day things. Thus, Vauban teaches that an army should entrench in the open:

"In order that a small number of men can resist a greater number.

"In order to be able to occupy important positions and hold them, with mediocre troops—much inferior to those of the enemy—without fearing him.

"In order to bar the entrance into our country to the enemy."

What a lesson in a few words!

If in spite of this, and in spite of the lessons of recent wars, the General Staffs have for a moment disdained the art and the necessity of entrenching in the open, it was because, overlooking these recent precedents, they have been hypnotized by the impressive memory of the Napoleonic campaigns. To use a mathematical formula, they have forgotten that the evolution of warfare is a *continuous function.* "They forgot that the art of foreseeing is but the extrapolation of a curve, and that in any well done extrapolation, the last points of the trace of the curve are the most important, and not any points taken at haphazard."

The Field Service regulations of December, 1913, said: "The artillery supports the infantry attack, it no longer prepares it." This doctrine, which might have been true against an unentrenched enemy, has been shattered against the armored parapets of the trenches and lacerated on the points of the barbed wire. It was fatal. Vauban calculated in his unpublished work that "one man well entrenched is worth six in the open."

With the present materials of warfare, the disproportion has become far greater, to the advantage of the entrenched combatant. For one thing, it is vastly more difficult nowadays to get up to the trenches because of barbed wire, something unknown to Vauban; furthermore he assumed all the adversaries to be armed with muskets, today there is the machine gun.

The machine gun tremendously decreases the advantage of the assailants, particularly if they are armed only with the rifle and the bayonet. Barbed wire can laugh at bayonets, and the rifle, with its flat trajectory, can hit only what appears above the parapet.

By sad experience, we have learned on the one hand to give new weapons to the infantry, and on the other not to send it against positions without preliminary artillery "preparation,"—the regulations notwithstanding.

The new weapon given to the infantry is the hand grenade—much more dangerous at short distances than the rifle, whose great range is of no value in trench warfare. There is no "dead angle" for the grenade.

With the hand grenade, attacking infantry is dangerous long before reaching the edge of the trench. The grenade can also with one blow put many men out of action. Furthermore in the communicating trenches, a turn, or a mound of earth is no longer a shelter for the defenders. The grenades pursue them, as the ferret the rabbit, in these sinuous approaches and galleries. It is of great utility against the hidden machine guns.

There are percussion grenades, and fuse grenades. There is a tendency to favor the fuse grenade, which, tho striking short of a trench, may roll into it and explode; but both have their advantages. The grenade used now resembles a lemon, in shape, more than the fruit from which it took its name.

Grenades to be fired from guns are now being manufactured by hundreds of thousands per day.

The preliminary artillery bombardment, to prepare the attack, was at first made short, to save ammunition, and to prevent giving warning that might save the enemy by affording him time to bring up reserves, etc. But experience again showed very cruelly that a short bombardment was not sufficient. It does not destroy the barbed wire nor sufficiently beat down the entrenchments which are strengthened with heavy timber and deep earth shelters. As to the matter of surprise, it was found not to have the importance ascribed to it, as there were always determined men on the watch with machine guns, by means of which a few aided by barbed wire could stop whole battalions.

To prevent the bringing up of reserves and of ammunition, the "Curtain of Fire" (*tir de barrage*) was devised. It creates a narrow, but deadly zone, like a long strait or channel of death—between the firing line of the enemy and his reserves.

The whole thing has come to this inevitable conclusion that if the attack is to be made without a terrific waste of precious lives, the artillery must destroy root and branch the networks (of obstacles) protecting the hostile line, also the entrenchments and shelters of that line itself, with their occupants, and must in addition separate that line from the enemy's reserves and supplies by an impassable, deadly curtain. For that, a tremendous supply of projectiles is necessary, and thus has been born the new tactics, with the slogan, "Cannon and Ammunition."

It must be as at Douaumont and Vaux where the assailant was able to occupy the desired position with his gun on his shoulder and a cigarette between his lips. We must attain that result soon and everywhere, for the blood of France must be economized at whatever cost. To make a shell a few hours are needed; to make a cannon, a few days and some money; but to make a French soldier, twenty years of tender care and affectionate anxiety, many lessons and much labor.

When one of these days we shall have enough material to enable our veterans to advance only over a terrain already conquered by our artillery, certain theories will have been battered down, but the most precious of human treasures will have been saved.

There are opponents of this idea. Not very long ago, one of our best military writers, Colonel Rousset, formerly professor at the war college, wrote apropos of the battle of Verdun: "Fire checks any force, and breaks its impetuosity, but causes only the pusillanimous to retreat. To win out over the others, to force them back in the offensive as in the defensive, shock action, or at least the menace of shock, is necessary. And only infantry is capable of producing the one or the other."

Notwithstanding the weight that attaches to these opinions, we cannot entirely agree with them. First, if the artillery fire cannot make the others fall back, it can destroy them, which is better than putting them to flight; and then the infantry will have only to take possession, without shock action, of the depopulated terrain. In the way of shock, there is none more vigorously efficacious than that of steel hurled by the powerful muscle of explosives. The Russian retreat of the past year, our own experience at the beginning of the war, and all those things which have since given us cause for redress, have proven incontestably that it was the German superiority in artillery that gave the German army its temporary successes: its artillery, like an immense broom, enabled it to sweep the terrain at a great distance ahead of its columns.

The Germans know this so well that they are hoping by a superabundance of artillery to compensate for their increasing numerical deficiency. And this imposes a new task upon us, to prevent the enemy's artillery from doing what ours does, *i. e.*, to counterbatter it into silence.

An understanding of the development of the use of artillery will explain some of the unusual peculiarities of the present battles. For example, one reads in the communiqués of both sides that a trench which has been taken by one adversary has shortly thereafter been recaptured by the other. This is continually happening, and is easy to explain. The violence of the bombardments, as they occur now concentrated upon a point, renders it absolutely untenable for the adversary, who must either be killed or withdraw. The struggle will be reduced to a combat between the opposing artilleries. That is, the victory will be won by the side having the dominating artillery—in range, skill in ranging, and caliber.

The most unintermittent duty of the artillery is that of interfering with and preventing if possible the supply of the hostile line. For this work exact information is necessary as to the time and places used in bringing up supplies. As hitherto the batteries must not themselves be too near the first line, because of the necessity of being defiladed, and to avoid being readily marked out for the hostile artillery fire, or becoming too vulnerable; also in order to facilitate their own supply. Advanced observers are indispensable to furnish information as to objectives and to direct the firing.

These observers are either in the trenches of the first line, or at well selected elevated points. They are the eyes of the batteries. In view of the paucity of personnel, the best first-line observers for the artillery are the infantry of the first line trenches. Communication is usually kept up by means of the telephone; hostile bombardment sometimes makes visual signals necessary, for which rockets are used, or sometimes messengers. The telephone is the best. The artillery now sometimes puts its own observers in the advanced trenches, but as its personnel is limited it continues to utilize that of the "line."

The trench artillery is served by cannoneers, but is connected with the infantry. The aerial torpedo, like its marine sister, has an oblong form, a fuse and fins or wings to assure steadiness in its course, and to

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make it fall on its point. While long range, heavy artillery is necessary for firing upon the hostile artillery, supplies, reserves, etc., in the closely contiguous trenches the feebler weapons can throw tons upon tons of explosives upon the adversaries. The low initial velocity of their projectiles permit lightening the barrels of the trench cannon, and diminishing the thickness of the walls of the projectile. While some trench cannon have the projectile loaded into the barrel, many are used like the little toy gun "Eureka" that shoots a projectile of which only the shaft enters the end of the barrel.

Their relatively light weight gives to trench cannon the great advantage of being easy to move about, to change position when in danger or for other reason, to find shelter, etc.

Trench artillery has also the great advantage that its projectiles can be charged with the more sensititve explosives. This fact multiplies our productivity of explosives, and enables us to reserve the costly stable explosives for the heavy artillery.

The reason for this is that with high initial velocity the inertia of the explosive within the shell drives the breech of the projectile against it with such force that only a highly stable explosive will fail of premature detonation. Among the less stable explosives, the *Cheddites* (named from the village of Cheddes in the Alps, where they are manufactured on a large scale) are much used in our trench projectiles.

Turning again to long range artillery, the heavy guns have shown themselves vastly superior to the light guns. Professor Rausenberger, one of the directors of the Krupp works, stated recently that the principal advantages won by his countrymen were due to their superiority in *heavy* artillery. His statement is incontestable.

The heavy guns fire much farther than the lighter ones, all other things being equal.

If one takes two guns (of which one is the exact reduction of the other) and gives to their projectiles the same initial velocity, the smaller projectile will go much farther, while the heavier one will be longer in falling to the ground. This is due solely to the resistance of the air. A stone will fall faster than a ball of paper, because it is less affected by the resistance of the air. That is why the substitution of iron bolts for stone secured an increased range. The resistance of the air is proportional to the surface of the object, and the value of the surface per unit of weight diminishes when the weight increases. Thus the surface of a leaden ball of 8 grams is not eight times greater than that of a ball of one gram, but only four times. That is why, having a greater initial velocity, the rifle ball does not go nearly so far as the shell of a 75 gun, and why the shells of the latter do not carry as far as those of heavy guns.

All this was known before the war. If, therefore, heavy artillery had not been developed in all countries, it was because it was considered insufficiently mobile for the high speed warfare which certain persons dreamed of. It was supposed that one would never want to fire at very great distances. This reasoning has been shown to be false. If the officer who does the firing does not see what he is firing at or where his projectiles fall, he has eyes that see for him. He has a fixed eye—the observing balloon; he has also a mobile eye—the airplane. The airplane is the periscope of the heavy gun.

Some will say, of course, that the heavy gun may be all right for the exceptional war of positions now in progress; but not for active campaigning. Nothing is more fallacious. Why did the French-English at Charleroi, the Russians in 1915, the Serbians, the Rumanians in the Dobrudja, have to fall back notwithstanding their prodigies of valor? Simply because the Germans had heavy guns that enabled them, from a great distance, to sweep the ground before them. In all these cases, the superiority of the range of the German projectiles permitted the Kaiser's troops to advance behind the shelter of a moving curtain of deadly iron, as if behind a distant shield.

Considering only the offensive of Mackensen in the Dobrudja, it was obviously his big cannon, which, destroying several miles in rear of the Rumanian front the railroad which supplied them, dislocating over the heads of their impotent field artillery their lines of communications, obliged our allies to retreat. It was always a war, not of position, but of movement, and the heavy cannon, rendered mobile by the mechanical traction of today, has shown itself to be the most efficacious weapon of the war of movement.

Its projectiles precede, as harbingers of death, the march of the troops, sheltering them at the same time from return thrusts.

All these heavy guns, of which many have recoil-mechanisms on the carriages, have become very mobile.

In the war of movement, the heavy guns, and only the heavy guns, can interfere with the distant supply system of the enemy, cut him off from his base by powerful curtains of fire, demolish his stations and railroads, and finally can pound his batteries at long range.

Also in trench warfare, in addition to their long range, the power of their projectiles assures the superiority of the heavy guns.

For firing upon troops in the open, the light guns are more efficacious than the heavy, and are therefore better on the defensive against troops advancing in the open to the attack.

When the enemy is in his trenches, heavy guns are more effective, light guns not being able to destroy his shelters, as they are now constructed.

Thus we find the supple 75 gun, formerly considered, because of its mobility, the best for the attack, a marvellous defensive weapon but a mediocre attacking weapon.

It is a strange reversing of rôles, a strange overthrowing of *a priori* theorists, but one which should inspire us with horror for the dogmatism of volatile systems and with respect for the experience of facts!

Moreover, in seeking further into the pages of an age-yellowed book, we find in Vauban's Treatise on Field Fortifications: "Any bombardment that cannot clean out the rear of the parapets and embankments is useless, since it cannot displace the troops and there-

fore cannot aid the attack." Is that not a clear statement of the prophetic vision of the indispensability of heavy guns for displacing the troops, and consequently for the attack?

Otherwise stated, one must be able in certain cases to fire upon defiladed objectives, and since in this war men, guns, material, depots, etc., are, as far as possible, moved and placed behind crests, folds in the terrain, etc., these cases are numerous.

This fact has led to the creation, beside the heavy long-range guns of a heavy artillery with curved trajectories. This special heavy artillery includes howitzers and mortars. We may classify the howitzers as short cannon, and the mortars as short howitzers.

There is, in brief, between the effect of the gun and the howitzer, the same difference as between the rifle ball and the hand grenade.

There is only one way to get the best of an enemy who hurls a thousand tons of shells upon you from afar, and that is to hurl upon him ten thousand tons, from a greater distance.

[The Artillery on the French and English Fronts. *La Guerra y su Preparación*, July, '17. 46,000 words. Illustrations, maps, diagrams and one table.]

PART I

General Considerations

First Visit to Somme Battlefield.

A Franco-British offensive launched July 1, 1916, in the vicinity of the Somme River, resulted in the British occupation of territory between the Somme and the Ancre.

Upon the request of the British Government a Spanish commission visited this battlefield in January, 1917.

The first things noted by the commission were:

1. The quantity of war elements used.
2. The effects produced.
3. The organization for an offensive, and especially, the artillery organization.

The observation of the commission is treated as follows:

a. An enumeration of all that was observed; in order that correct conclusions may be drawn and proper comparisons made.

b. The statement of those conclusions which are proven by the latest developments in warfare; and the enumeration of those developments which we ourselves can make use of.

Indentity of the Fundamental Ideas in All Wars

The latest scientific advances incorporated into the art of war, do not modify the fundamental ideas of strategy and tactics that we have always had. The enemy will strike at the weakest point; and ultimate victory depends upon the man-to-man fight, and personal valor as much now as 3000 years ago.

The Character of Trench Warfare

Trench warfare is simply a means of saving men. By the use of intrenchments, fewer men are kept in the "holding defense" and more are available for attack. The success of trench warfare depends upon preponderance of material, liaison between the combatant arms, and better instructed men than the enemy possesses.

Tactical Employment of the Artillery

PRELIMINARY PERIOD

The artillery has leveled entire cities, so that their existence is known only by a red blotch on the terrain caused by pulverized brick. In the actual firing line shell craters are so uniformly and closely grouped that aero-photographs of the terrain resemble mechanical drawings of regularly placed excavations. One of the British generals referred to his aero-photographs as proof that the artillery had carried out his orders.

The expenditure of shells, projectiles and aerial bombs reaches figures that are fantastic in size, since the proportion of artillery to the other arms has been increased, and the artillery calibers augmented. This increase by one belligerent was of necessity met in a similar manner by all the others.

Whether or not active trench fighting is in progress, the enormous consumption of ammunition continues; and is explained by the fact that every action must be preceded by an intense artillery bombardment, with the object of destroying everything that can be of help to the enemy; besides increasing his casualties. This bombardment is independent of the action itself.

When an enemy is intrenched to the extent that his defensive system is a series of strong points, light artillery fire must be supplemented by the fire of higher powered guns, of more destructive guns, or of those which combine both characteristics.

In other words, terrible effect must be produced in his shelters, his defensive and offensive elements must be destroyed, made uninhabitable and abandoned. Death and disorder must be introduced into first line trenches, communicating trenches—which are the veins and arteries of the firing line, commanding officers' posts, railroad centers, ammunition and reserve depots, and into every remote point of the enemy's position. This requires a constant methodical and extremely violent bombardment.

Heavy guns, long ago relegated to permanent fortresses, have been brought back into the mobile army by the use of trucks and tractors. They are indispensable auxiliaries of the field piece, in advance and attack, during which times they remain in position well behind the lines, where their vulnerability is decreased, ammunition supply simplified, and effect retained due to their range.

Fire control is exercised from observation posts in the trenches which are connected with the batteries by telephone. Aerial observers also exercise fire control thru wireless telegraphy. Realizing that these means of communication sometimes fail, visual signals are also provided. The importance of a heavy bombardment is well summarized by Gen. Nivelle, who says, "War is a question of tons of metal. The belligerent who attacks with 1000 tons of explosives can only be defeated by employing 10,000 tons. The army that does not possess long range, mobile artillery, of

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large and medium calibers, with which to execute successfully the period of prepartion, both in attack and defense, should hope for no other result than a truly complete annihilation."

Two proofs of this statement were the early German successes against the French, and the Rumanian retreat in Dobrudja and Wallachia. In both cases the Germans possessed the artillery of largest calibers, which silenced the opposing artillery without being touched itself.

The use of long range artillery is the modern application of the ancient tactical principle of crushing the enemy with hurled weapons, at the longest possible distance.

The reconnoissance must continue during the entire bombardment. It is carried out by airplanes, captive balloons, aerial and grounds raids. The ultimate plan of attack will be influenced by the reports of these reconnoissances. All batteries, taking part in a bombardment, must be thoroly hidden (camouflaged) from aerial observation. Gun crews must remain under cover, and shelters, ammunition depots and storehouses harmonized with the surrounding terrain. When a battery is located it should change position immediately.

The general commanding the artillery receives orders from the commanding general, the former then issues the orders for bombardment, so that the entire attacking front is covered.

For this purpose the front is diveded into sectors to each of which is assigned a certain group of batteries under one commanding officer.

The Sector Artillery Commanders issue orders to Battery Group Commanders, who in turn issue their orders to the captains commanding batteries.

Firing is done by map ranging, the accurate staff maps of peace time being supplemented by aero-photographs showing all present fighting positions.

Each sector is photographed from a given altitude by a squadron of airplanes and the resulting negatives are taken to the squadron photo-automobile. This vehicle is fitted up for rapid photographic development, and here the sector photographs are developed, printed, assembled and delivered in oriented map form to the Sector Commander. He, in turn, marks copies for the Group Commanders, who mark and transmit copies to the Battery Commanders.

The artillery organization is similar to that in a permanent fortress, tho more complicated, due to the greater number of elements, and their modernization.

Period of Preparation

During the preliminary period, all the artillery is under one commander. Now this is changed. All batteries which are to co-operate in the attack are regrouped and go under one command, and all batteries which are to fight hostile artillery are regrouped under another command. The general commanding the artillery controls the ammunition supply, and replacement of casualties, for both groups, but retains fire command only of the second group. However, he may make such rearrangements of batteries as the battle developments justify.

[The author gives examples of artillery orders and the manner in which each subordinate commander carries out these orders.]

During the period of preparation, each subordinate artillery commander must maintain communication with his immediate superior.

Disposition of Machine Guns and Bomb Proofs

Machine guns are placed at intervals of 25 meters, under 10 meters of bombproof cover. Between every two emplacements are cases of 20 hand grenades, also gas and air pressure tanks.

Observation stations and posts of commanders are well camouflaged, and in communication with each other. The former are equipped with machine guns.

Special Organization of Forces

The commandant, school of fire at Mailly, explains the new infantry organization as that best adapted to meet any emergency.

Each company is divided into four half-sections. The first half-section consists of eight grenadiers equipped with hand grenades only. These men lead the attack and each has a substitute, who follows in file armed with a rifle. These two files are followed by four others armed with automatic rifles and a gun crew of two men per rifle, one carrying 1000 rounds.

The other half-section is led by four rifle grenadiers and four substitutes. The other men are armed with the rifle and sabre-bayonet.

Artillery Utilized—Special Fuses

In the time of preparation, pieces of large and medium caliber fire explosive charges. These demolition batteries have the barbed wire entanglements as objectives. Antenna fuses are preferred, as they insure explosion above the ground.

Trench Artillery

This is used to supplement long distance fire from heavy guns. It is extremely varied in form. Its chief characteristic is that the explosive carrier does not enter into the piece, and does not support the powder pressure on discharge. In this way a maximum weight of explosive and minimum of shell can be used.

Scale of Projectiles

In point of range they are, hand grenades, trench mortars, howitzers and cannon up to the 52 cm. gun.

General Considerations

The artillery should produce such an effect upon enemy works and personnel during the time of preparation that the infantry arrives at the enemy position without a single casualty. The large caliber guns by their long range and mobility strike the enemy's heart while the trench artillery and hand grenades pierce his skin. Howitzers and guns of large and medium caliber should be the only ones used for demolition and destruction.

[As an example the Battles of Arras and of the Yser are discussed.]

Employment of Trench Artillery

Trench mortars fire a maximum weight of 100 kilograms of explosive. Their employment continues thru the time of preparation and during the attack. Their positions in the trenches are changed as soon as discovered.

Trench Artillery Schools

The study and practical work in trench artillery is being carried on by the British at Bryas, and by the French at Bony. Recruits and veterans attend the schools.

Measures Taken Before an Operation

These include before every operation an inspection of rifles, cannon, machine guns, trench mortars, automatic rifles, hand grenades, gas apparatus, ammunition supply service, fortifications, rations, sanitation, liaison and communication. The final steps are: the reports of reconnoitering patrols and airplanes, insuring of communication between commanders and troops, co-ordination of time-pieces and issuing of the attack order.

(An example of attack order is given.)

Period of the Attack

Barrage Fire.

This name is given to the fire of light and medium caliber artillery, which precedes and accompanies the infantry on its assault. The ammunition is shrapnel, high explosive and gas shell. This fire establishes a separating wall between the defenders of the first line trenches and their reserves.

(The second phase, battle of Arras is given as an example.)

The idea held by French and English officers is best expressed by the statement that the artillery attacks and the infantry occupies. The artilleryman's difficulties begin after the first infantry wave has taken the final trench, and the second infantry wave has started its advance and enemy batteries and machine guns have opened fire. Now the barrage must be moved behind the second line; enemy batteries silenced; and machine gun emplacements located and destroyed. This last requires a combined study of the terrain before the attack by infantry and artillery officers.

Technique of the Barrage—The idea is to produce two parallel walls of explosives: one by the artillery, thick and overwhelming, behind the line of assault; another by the infantry in the objective trench itself. At a certain instant by the clock both walls will move forward. The infantry should move over ground already conquered by the artillery, arriving at the objective without losses. But the infantry must guide itself on the barrage, otherwise terrible losses will be suffered.

Moving Barrage—The barrage is moved by an increase in range, as the assault progresses from second to third line trenches. The quantity of ammunition used is indeterminable, depending upon the density of the barrage. The Germans are fond of firing immense quantities of ammunition, even at an imaginary or ideal target, between the first and second line trench.

The moral effect of a dense barrage on infantry may or may not be noticeable. The natural impulse is to seek death rather than to await it cold-bloodedly in the trenches, so that infantry will rush thru the barrage regardless of its density.

Barrage fire was first used during the Russo-Japanese War, in the battle of Da-tchi-tsiao (July 11-24, 1904). It was used to establish a curtain between the batteries and their ammunition supply.

Counter Batteries Fire for Effect—In the expenditure of ammunition for effect or against counter batteries the following rules are used. A shrapnel burst, at 3 mil. elevation, covers 25 meters of front and 100 of depth. Density is figured on a front of 25 meters. That is, a density of $4 = \frac{100}{25} = 4$ rounds or 1 round per gun of a battery; a density of 8 requires 2 rounds; 12, three rounds, etc. Every ordinary objective has a tabulated density.

A high explosive burst covers a front of 50 meters and a depth of 25. A density of 8 is deemed sufficient against troops. Against artillery, tactical considerations govern the density, ordinarily it will be one round per minute per 25 meter front.

The barrage fire will consume a maximum of artillery and a minimum of infantry.

(As an example the Verdun battlefield, and the capture and re-capture of Fort Vaux are discussed.)

General Deductions—The great war illustrates for the first time the proper use of artillery. It proves, beyond question, the necessity for detailed and extended artillery study, by officers and men, before the maximum effect can be derived from artillery fire. In this respect, the study of orders and communication cannot be overestimated. Liaison and communication between artillery and infantry commanders, and within the artillery must be maintained thruout the entire operation.

(An example and discussion are given of orders from and to all artillery commanders in an offensive combat. The duties of all officers are discussed.)

PART II

Matériel and Its Employment

The adoption of guns of different calibers must be accepted as a necessary adjunct to modern warfare. The weakness of the French in the first days of the war was their faith in the 75 mm. gun, to the exclusion of all others. Their strength has been the prompt realization that different calibered guns were necessary. The English were also deficient in calibers at the beginning of the war. This deficiency has been supplied. The chief reason favoring a field piece of one caliber only was the ease of munitioning. To-day the munition question is as important but the use of various calibered guns is the surest way of economizing ammunition, and facilitating supply.

The following comparisons from Glück illustrate the point: The impact of a 75 mm. shell or 15 cm. German howitzer was enough to dismount an enemy's

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piece. Now, in order to obtain this impact it takes eight 75 mm. shells and from 60 to 70 15 cm. howitzer shells, or the equivalent of one-tenth the load of a 75 mm. ammunition cart, and two loads from the 15 cm. ammunition cart.

In order to reach and destroy, with some probability, a trench at 3000 meters, 30 to 40 projectiles of 15 cm. are required per yard of trench or 3000 to 4000 rounds per one hundred yards of trench, or 150 cartloads.

To gain a single hit on a wall 2 meters high and 15 meters wide at 1500 meters, six rounds from the light field piece are necessary, or 62 from the heavy howitzer. The advantages of the heavy gun in these cases are apparent.

Of necessity each caliber has a special task for which it is fitted and it is of primary importance that the various calibers be used against their proper objectives. High angle fire from various types can be used against barbed wire. The 75 mm. field piece is employed against accessory defenses, as well as the 105 mm. gun. When used against barbed wire special fuses to insure above ground explosion must be used. Against blockhouses, machine gun emplacements, and flanking strong points the 90 mm., 95 mm., the short 155 mm. as well as the 120 mm. mortars.

Trench mortars operate against the enemy's personnel and special points in his trench system. They are supplemented by hand-grenades up to a range of 40 meters.

In attack and barrage fire, as the destruction is intended for personnel only, the 75 and 105 mm. rapid fire guns do the work.

The defense against attack requires a distribution of calibers for different tasks.

Pieces Employed on the French Front—Besides the 75 and 65 mm. mountain guns, France has the 120 mm. long and short models, the 150 short model, the 155 mm. Rimailho, and siege mortars, chief of which is the 270 mm. Besides these are the latest models called guns of semi-new caliber, adapted to trench or open warfare. These are: The 105 mm. field piece, range 11 kilometers, double shield, mount of high mobility, projectile weighing 14 kilos. and rate of fire 15 per minute; the 120 mm. rifle, range 11 kilometers, projectile 20 kilos; the 155 mm. Schneider howitzer, muzzle velocity 480 meters per second, range 9800 meters, projectile 45 kilos; the 155 mm. long rifle on tractor mount, length 16.5 calibers, range 11 kilometers, projectile 43 kilos, rate of fire, 6 per minute (ammunition for this piece is produced at the rate of 20,000 rounds per day); the 220 mm. mortar, range 10 kilometers, tractor mount, easily served; the 280 mm. Schneider mortar, 12 calibers in length mounted on four trucks, carriage, rifle and cradle respectively, range 10 kilometers, projectile 275 kilos, highest angle of fire, 65 degrees, muzzle velocity 320 meters per second; the 400 mm. railroad mount, projectile 500 kilograms, explosive charge 15 kilograms; the 520 mm. mortar, range 18 kilometers, weight of gun 41 tons, gun with carriage and truck 190 tons, weight of projectile, 1370 kilos, of explosive charge 370 kilos. This projectile is 2.05 meters high. (This mortar costs 1,000,000 francs, each round fired costs 90,000 francs.)

The calibers are completed by the new 75 mm. rapid fire rifle for horse batteries, and the adapted naval guns of 240,305 mm. and the 370 mm. howitzer. In the Creusot works, development and modernization are being constantly carried out.

Pieces Employed on the British Front—These are: the 3.3 inch rifle, range 6000 meters; the 5.0 inch rifle, range 9140 meters; the 6.0 inch howitzer, range 9000 meters; the 9.2 inch, 11 inch and 12 inch howitzers. The artillery complement is completed by the 15 inch naval guns, railroad mount, range 11 kilometers, weight of projectile 770 kilos, rate of fire 1 round per minute.

Anti-aircraft, French, and Armored Matériel—Anti-aircraft matériel is of two kinds: that which is improvised from the 75 mm. rifles; and the specially constructed anti-aircraft guns. Among the latter is an automatic anti-aircraft rifle of 75 mm. caliber mounted on a motor truck. It is served by three men: the gun-pointer on the left, the loader on the right, and the ammunition carrier. The gun pointer simply keeps his piece on the target. The battery commander makes all corrections and fires the piece. Both these operations are done electrically. There is another anti-aircraft model of 10 cm., fixed mounting, controlled as are our seacoast defense guns.

Anti-aircraft batteries of permanent character, are located at all important places open to aerial attack. Their fire is in the nature of an aerial barrage against raiding or reconnoitering aero-patrols.

Trench Artillery—This includes everything from the ancient catapult to the simple modern trench mortar. The ranges of these instruments do not exceed 1000 meters. The English have three favorite models: the 8-inch light weight mortar firing an ogival cylinder of 100 lbs. charged with 56 lbs. of ammonal, to a range of 400 meters (mounting allows vertical and horizontal traversing); the 4-inch mortar firing 2.5 kilos of ammonal, and the more complicated model which fires a spherical bomb holding about 15 lbs. of ammonal. There are other simpler and lighter models.

The French trench mortars are in reality torpedo throwers, as the firing charge does not come in contact with the shell itself. The French trench artillery has been calibrated to correspond with the artillery as far as possible.

This trench artillery is a means of using defective artillery ammunition. The projectiles are provided with balancing fins and re-timed. In this form they are called torpedo grenades.

German trench mortars (minenwerfer) captured in the battle of the Somme are on exhibit on the Esplanade des Invalides. They show more development and less variation than the Allied models. The Germans have the light model 70.5 mm., throwing a 2 kilo grenade 350 meters; the medium model 170 mm., throwing 70 kilos 750 meters; and the heavy model, 250 mm., throwing 150 kilos 420 meters. There are several examples of larger calibered mortars but they are not numerous.

Armored Artillery—This artillery was developed for the purpose of accompanying the infantry in an attack. It is the modern tank. The armament consists of machine guns, and a light field piece. The French use the 75 mm. Saint Chamond. The real value of the tank has not yet been established.

(The author discusses English and French models.)

Aero Matériel—As far as the artillery is concerned aero matériel is used to open, correct, and cease firing. Aerial observation of fire has become a necessity.

Captive Balloons—These are used in great numbers, but at a long range from the firing line. They occupy an intermediate position between the ground and the aerial observer.

Application of rules of fire

(Reference is made to French Maneuver Regulations 1913, and Memoir, Feb, 1915, Spanish School of Fire.)

Use of Wireless Telegraphy—Rules—The latest regulations are the Swiss. The firing battery is notified when its airplane leaves, as is the ground receiving station. Upon rising, the aerial observer calls the battery. The battery answers by displaying a strip of cloth. The aviator having reconnoitered the target sends "X Y R"—indicating his arrival, and "S" meaning "Commence Firing."

Suppose the first round is one target front right—aviator sends repeatedly "X-1R-2W." On opening fire with this correction the battery displays a cloth signal. The aviator sends "X-S" meaning "continue the fire." Suppose the second round is 3 target fronts short and to the right, the aviator sends "X-ZR-3K" followed by "X-S." If the 4th round is a hit the aviator sends "X-ZM-W-K-ZN" followed by "X-S."

The observation of salvos is similar, with corresponding signals. (A Swiss signal code is given.)

The artillery observer will always be protected by light, high speed fighting planes.

Artillery reconnaissance planes carry one or two men. In the former case, the pilot is the observer; in the latter, the pilot and observer are separated so that mechanical communication must be resorted to. This is done by means of a dial and two clock hands placed in front of the pilot. One hand is connected to and moves with the observer's glass; the other is connected to, and moves with the control mechanism of the plane. The pilot controls his machine so as to keep these two hands superimposed. The connections are such that by doing this his course corresponds with the observer's line of sight.

One or two fighting planes are assigned to each observation plane.

Bombing and Fighting Planes—These are used against important points within the enemy's country, such as railroad centers, depots, convoys, etc. During the battles of the Somme and Verdun fighting and bombing planes took part in the assault itself, attacking the trenches with bombs, and machine gun fire, from elevations of 300 meters and under.

Aerial Bombs—These vary in weight from 25 to 100 kilos. The target to be attacked will decide the weight of bomb to be used. In many cases, as in the raid on Bar-le-Duc, great quantities of small bombs fail to produce the desired effect. Heavy bombs are dropped more accurately than small, light ones.

Aerial progress is obtained by the manufacture of lighter motors (the Hispano-Luiza motor averages 1 kilo per horsepower); by the manufacture of greater numbers of airplanes; new explosives; and aerial bombs.

Part III

Industrial Services

The manutacture of armaments is carried on at Creusot and Citroyen.

The Creusot Plant—This establishment is devoted to the manufacture of steel, cannon, and projectiles, with the exception of the 75 mm. rifle and its ammunition.

The plant is capable of pouring Bessemer and Martin steel to an ingot weight of 24,100 kilos. All by-products from coke and other gases are gathered in the blast furnaces. From these are extracted benzol, which is specially treated for the separation of benzine and toluene. Forging and welding facilities for various steels of all sizes are provided, as well as steel presses, mills, and hammers. There are tools for the production of everything from the 520 mm. rifle and its ammunition, to the smallest steel tubing. In the mechanical shops the projectiles for all calibers from the 155 mm. to the 520 mm. are turned out, the 155 mm. at the rate of 22,000 per day. Creusot is being enlarged by the installation of eight 60 ton Martin-Siemens steel furnaces. This establishment has its own proving ground. It employs 22,000 people, of whom 14,000 are women. The motive power used is 15,000 horsepower, provided by the explosive gases from the blast furnaces. Creusot is defended against aerial bombardment by anti-aircraft batteries.

The Citroyen Factory—This immense plant, devoted to the exclusive production of the 75 mm. projectile, is full of identical machines which carry the 75 mm. projectile mechanically from one operation to another. It is systematically constructed, ideally systematic, and economical in operation. It employs 12,000 workmen, of whom 8000 are women, working in three shifts of 8 hours, and turning out 60,000 projectiles per day. Bar steel is received from the United States, and by special processes is shaped, milled and then turned. The final processes are carried out in the shops. Shrapnel balls are manufactured at the rate of 10,000,-1000 per day. The lead is a Spanish import. (The processes are discussed in detail.) Inspection rooms are provided where every projectile is inspected before being sent out.

Tho the propulsion and explosive charges of the explosive grenade are theoretically wrong, the use and consequently the manufacture of this grenade shell continues.

The daily production of steel is 100 tons, of lead 150 tons. The daily expenditure of each is about the same.

Powders and Explosives

These are manufactured almost entirely at Angoulême, on the Charente River.

ARTILLERY—Continued

The author gives a detailed description of the plant, of the methods used in the manufacture of guncotton, the mixing of acids, the treatment of crude cotton, the Thompson method of nitration and its advantages, manufacture of trinitrotoluol, the universal use of trintrotoluol, the production of schneiderite, the Valentinier method of manufacturing nitric acid, the production of cyande and calcio-cyanide. The production of óleum, and the use of fluxes.)

Angoulême produces daily, to tons of schneiderite, 70 tons of guncotton, and a total of 110 tons of other explosives. 12,000 employees, 6000 of whom are women, work in the plant.

The necessity of war has led to the production of benzol, and its components, benzine and toluene, from illuminating gas. The method of extraction is as follows. The gas is first washed in coal tar oil which absorbs the benzol, it is then extracted from the coal tar oil by steaming and condensing, next it is rectified in towers, and finally it is purified by using sulphuric acid and soda. One cubic meter of gas gives 20 grammes of benzol, from which are extracted 10.2 grammes of benzine and 3.4 grammes of toluene.

Résumé and Conclusions

(The author concludes with a résumé on matériel, metallurgical industries, chemical industries, varied operations, and a detailed discussion of instruction of all arms.)

With reference to liaison, the old idea that the artillery must guard its secrets against the other arms, no longer prevails. Each arm is given its proper amount of importance, and a perpetual communication kept between commenders of all arms. Liaison is made the subject of special study. Instruction work in all services must be carried out behind the lines, at instruction camps. In this training, combined maneuvers should be frequently held, map problems worked out, the sending of written messages practised, and field firing of combined arms carried out.

Appendix

Application of the Seismograph—This instrument has been lately applied to ranging and locating batteries and to the determination of the caliber of any gun fired. Two seismographs are used on a fixed base. The initial lines which mark the registration of a discharge always point towards the discharge.

[Naval Guns on the German Front. *Scientific American*, Oct 20, '17. 700 words.]

The recent increase in German long range fire on the western front suggests that the Germans must have been stripping the older battleships and cruisers of their guns, and placing these on howitzer and railway mounts for land service. Without diminishing the strength of the main fighting fleet the Germans could secure from older vessels twelve 11-inch, seventy 9.4-inch, fourteen 8.2-inch and 234 5.9-inch guns. The putting of these old ships out of commission also would release nearly 15,000 men for manning the German submarine fleet.

ASPHYXIATING GASES

[Modern War. By Carlos Vitoria. *Memorial de Caballeria.* Sept, '16. 1400 words.]

Asphyxia as a proceeding of war has made its appearance upon the battlefield. Asphyxiating gas was employed for the first time and by the Germans on 22 April, '16, near Ypres, in preparing for the attack against the sector Steenstraate-Langemark. The gas used is formed by a mixture of chlorine, bromine, formol and other chemicals, with chlorine predominating. Chlorine gas is fatal in its effects when the quantity in the air is in the ratio of 1 to 1000. In the ratio of 1 to 100,000, it is dangerous when exposure to its action is of long duration. A light breeze disperses the vapors rapidly. A sudden change of wind may return the gas upon those liberating it. The utilization of toxic gases in war has been studied for years. The Germans have developed its practical use. The liberating apparatus consists of a metallic cylinder 25 centimeters in diameter and 1.35 meters in height. At one base of this container is a metal tube 2 meters in length with a valve for opening and closing it. This permits the gas to escape into another cylinder from which the liberation of the gas is regulated by compressed air or carbonic acid. Liquid chlorine is used in some apparatus. To produce 200 liters of gas (which is the quantity needed for one meter of front), 600 grams of chlorine are required. In one attack, the Germans produced a cloud of asphyxiating vapor 10 meters in height for four hours on a front of 8 kilometers. This emission caused mortal suffering among the Allied troops for 2 kilometers in rear of their first line, and partial effects were obtained at a distance of 5 kilometers from the producing apparatus. The use of protective masks at once became obligatory. The Russians in some cases prepared brush piles in front of their positions; upon the approach of the gas clouds, these piles were soaked with inflammables and fired, the new column of air thus formed diverting the menace. While the cavalry ordinarily should not have to confront this new "arm," occasions may arise in modern warfare when precautionary measures against it will be necessary. Masks should afford protection to the men, but what of the horses! The horses could be masked only while at rest. If worn while in motion the impediment to respiration caused by the masks would quickly exhaust the animals, since it is a well-known fact that the lungs tire sooner than the muscles; the shock of a charge would therefore be greatly reduced.

—Protection Against

[Weather-cock. By Lieut.-Col. E. F. Delaforce, R.F.A. *Jour. Royal Artillery*, Apr, '16. 250 words. Illustrated.]

(In order to obtain warning of the possibility of a gas attack, a weather-cock is an essential part of the equipment of every unit. The author describes one which works very satisfactorily and can be made easily from such improvised materials as are available in the field.)

This weather-cock is designed to admit of being put up at some distance from trees or buildings, and yet

allow of easy and accurate reading from the billet or dugout (with field glasses if necessary).

The materials used include: a 13-pdr. or 18-pdr. cartridge case, some iron rods, rivets, sheet metal and other materials which can always be picked up in the field. The body of the weather-cock is graduated and provided with a pointer to show the cardinal points of the compass. A flash light for night reading, controlled from the dugout, may be provided as well as an electric bell to ring when the wind is in a dangerous quarter.

—Use of in Europeon War

[A Honk! Honk! in the Trenches Means "Don Your Gas Masks!" *Popular Science Monthly*, May, '17. 300 words. One illustration.]

Gas masks are necessary and they must be kept at hand ready for instant use. Various mechanical devices, among them the klaxon horn, have been used to give the signal for donning the masks in time to avoid danger from gas attacks.

[Suffocating Gases as Instruments of Warfare. By C. G. von Otter. *Artilleri-Tidskrift*, Parts 1 and 2, '17. 3450 words.]

At the Hague Congress in 1899, the governments represented—and all the present warring powers were there represented—pledged themselves not to use any projectiles whose only object was to give out suffocating or poisonous gases. At the Congress of 1907, article 23 of the rules adopted for war on land states, "It is expressly forbidden, (a) to employ poisons or poisonous weapons."

In spite of this, poisonous and suffocating gases were used early in the war on both sides. Each side accused the other of beginning it. The Germans made a gas attack the first time on April 22, 1915, according to French reports. Nearly all explosive substances used in projectiles give out poisonous gases which, if inhaled in sufficent quantities, cause suffocating spasms or even death, but there is a long step between these and gas projectiles whose principal object is to spread poisonous gases when they explode.

For the first gas attacks it appears that chlorine gas was principally used, but later bromine, sulphur dioxide, nitrogen dioxide and carbon dioxide were used and in October, 1915, the Germans are said to have used hydrocyanic acid.

The substances used in gas warfare should fulfill the following conditions:

1. They should be able to put a man out of action as quickly as possible.

2. It must be possible to obtain them in sufficiently large quantities.

3. They should be considerably heavier than air.

4. It should be possible to compress them into a liquid form without too much difficulty, and this liquid should have a relatvely high specific weight.

5. Their boiling point should not be too high.

6. It should be difficult to neutralize them.

A list of thirty-one gases used during the war, or that could be used, is given.

Chlorine is the principal gas employed and a description is given of how it may be obtained, how stored and how it affects persons exposed to it, also the means employed to neutralize or prevent its action.

The gases are used in two ways, as gases projected in large quantities in waves thru a hose from large containers, and in shells which on exploding release the compressed gas contained in them. For the first method it is essential that there be a moderately strong wind blowing in the direction of the trenches attacked; that the ground be horizontal or gently sloping toward the enemy's position; there may be fog but no rain; and a sufficient quantity of the gas must be available. The attack must also be in the nature of a surprise and the gas containers must be so located and protected that they cannot be damaged by the enemy's fire.

After a position has been captured, the gases remaining in it must be quickly gotten rid of by spraying the place with a neutralizing chemical.

While the main attack is made by means of a gas wave, the position attacked is often isolated by a "barrage" of gas projectiles fired beyond it.

The Germans are said to have two kinds of gas projectiles, marked T and K, the former containing gases of great density for use in firing against trenches and for "barrage" fire, the latter for use in firing against a wooded area.

The poisonous effects of the gases have been noticed over 1500 meters behind the position fired at. 0.1 per cent of chlorine in the air is fatal, and even 0.01 per cent is very dangerous if inhaled. Before protective measures were taken there were many victims of the gas attacks, especially among the Allies at Ypres in 1915, but soon suitable gas masks were invented and used. These have proved very effective remedies, but it is necessary that they be provided with the proper neutralizing chemicals for the particular kind of gases employed, and on that account it is very necessary to know the kind of gas the enemy uses.

[London Letter. *N. Y. Nation*, Aug 2, '17. Quoted.]

The effects of actual "gassing" are various and strange. In some cases they do not disclose themselves for a week. A comrade who was unknowingly smitten at the same moment as my friend went about his daily work in ordinary fashion. On the seventh day the poison, having got thoroly into his blood, developed in sudden violent attacks of lunacy. It was found necessary to bind his limbs and convey him to a base hospital, where three days later he died a raving lunatic. The best thing to do when "gassed"—a proceeding not always possible—is to lie absolutely quiet. Any motion of the body sets the poison coursing thru the veins with increasingly dangerous effect. Temporary paralysis is a common result of the poison, and neuritis an invariable and prolonged accessory.

Recently the Germans have invented a process of "gassing" other than the blowing of the poison in

ASPHYXIATING GASES—Continued

the faces of opposing ranks. They have made a shell which they charge with poisonous gas of exceptional gravity. Selecting a windless day they bombard detachments with these missiles, preferring those situated in low-lying land. The bombs, when they strike the ground, do not explode. The contact merely fractures a carefully prepared weak place in the bomb, whence the poisonous gas slowly issues, lying like heavy mist on the ground, making life unbearable for man and beast. Up to the present time they hold the monopoly of this devilish device introduced into "the noble art of war."

[Gases in Warfare. By Colonel John Q. Tilson. *Infantry Jour.*, Aug, '17. 6000 words.]

(Extracts from speech in the House of Representatives, June 27, 1917.)

Our road to victory is thru the air. Enormous transportation difficulties lie in the way of transporting 2,000,000 men to Europe and supplying them. But 100,000 men in the air would make an overwhelming fleet that would blind the eyes of the enemy.

Germany had imagination—first the 42 cm. howitzers, next the Zeppelins, and next the deadly submarine. Then came the 50 tons of chlorine gas to a mile of trench let loose against the Canadians at Ypres.

Germany was best prepared in airplanes at the beginning of the war. Superiority has been first on one side and then on the other. Larger and faster machines have been developed. A Handley-Page machine has actually taken two small airplanes with their pilots on its wings, risen 10,000 feet and then launched them.

Gas bombs can be launched from airplanes, and gas is now a recognized weapon of warfare. Masks were devised as a defense against gas. (Three types shown and described, including the British box respirator, good for 10 hours' use.)

Mastery of the air will insure a successful use of gas, and do much toward making war unbearable. Other and different gases can be used from airplanes, and gas can be made the turning element in the war. The civilian population should, of course, be warned from the scene of prospective operations. The operations could be extended over such a great area that the provision of masks would become impossible.

We have great facilities for manufacturing aircraft. We have solved the engine problem.

(On a suggestion that officers returning from abroad reported that the masks were such efficient protection that both sides had practically discontinued the use of gas, the speaker said that this was probably true of cloud gases, but that the proposition was to enlarge the area of gas operations so that thoro protection by masks would not be practicable. A man must be prepared to don his mask in six seconds, and with gas bombs falling over large areas, there might not be time to put them on. The use of a deadly delayed-action gas—phosgen—was mentioned and its deadly effects described.)

ASSES

[Utility of the Ass for Special Services in the Army. By F. Abeilké. *Memorial de Caballería*, May, '17. 1600 words.]

(A recommendation for the substitution of asses (burros) for mules in certain transportation units. It is thought that asses would be especially useful in regimental services in the transportation of food and ammunition from the rear to the firing line. An instance is cited during the battle of Verdun where about twelve asses in charge of one soldier transported 1000 kilograms of supplies without trouble or delay. Under the old system of regimental transport this would have required about ten mules and twenty or more men.

ATHLETICS, Military

See
GYMNASTICS, MILITARY

ATTACK

See also
AERONAUTICS—ATTACK
INFANTRY—TACTICS—ATTACK

[The Great Offensive. Editorial. *The Army and Navy Gazette* (London), Sept 30, '16. 1200 words.]

We have seen that attacks must be maintained, and the only way that this can be done is by collecting and employing masses of guns of the largest and indeed of all calibers, and firing shells by thousands by day and by night, ceaselessly upon every part of the enemy's defenses; that any delay during or cessation of the attack gives opportunity for a brave and desperate enemy to assume the counter-offensive, with the possible result that portions of our gains may be recaptured, making it necessary for all the bloody work to be done over again. So we have seen to our surprise and admiration that there has been no cessation in our offensive; that so soon as ground has been won arrangements are already in hand for fresh attacks; that those proceed at once and that the enemy is afforded no time for the careful, slow, and methodical preparation of the offensive-defensive of which he has shown himself a past master.

[The New Warfare at Verdun. By Arno Fleurot. *Land and Water*, 30 Nov, '16. 2800 words.]

Up to the time of the regaining of Verdun's outer defenses, the French had been handicapped by the lack of heavy artillery. General Mangin, who directed the artillery fire, felt rightly that he could blow the Germans completely off Terre Froide ridge. Using heavy pieces only, and firing contact shells, he covered the entire ridge with fire. After the expenditure of over a million shells the attack began. The earth in front of the French troops no longer showed a piece of barbed wire or a trench. Its defenders were crouched in the shell craters. Over them swept a curtain of French fire from the 75 and 105 millimeter guns. The first line of French riflemen was not very thick. It was so far forward that it was under the edge of its own curtain of fire. Of the 20,000 Germans in the first line of defense not one escaped.

Behind the first line came the "trench cleaners" who were armed chiefly with bombs to throw into the shelters. Behind the "trench cleaners" came the main body of infantry, supported by machine guns, and moving in comparative safety.

The commanders of the artillery two or three miles back, and the commanders of the first, second, and third lines of infantry worked with their eyes on their watches. The attack was scheduled for a certain minute. At that minute the curtain of fire fell just before the first French line. Each minute the curtain moved forward 25 meters, nearly 80 feet. The Germans either did not have the troops to reinforce strongly, or were unwilling to have them annihilated. The French met resistance but not in sufficient strength to slacken their steady progress of 80 ft. a minute. That speed may not seem much, but it was made up and down over shell craters.

The essentials of this latest form of attack were: (1) plenty of heavy artillery supplied with millions of shells; (2) an equally good supply of lighter, quick-firing artillery; (3) light machine guns that can be carried by one man with helpers bearing ammunition; (4) heavier machine guns to back them up. All other considerations are variable.

Carried out on a wide front, so rapid an advance as this can only be guided from the air. Airplanes must fly immediately over the advancing troops reporting the progress back to the artillery commander.

The whole plan of the battle was so scientific, so carefully worked out and scheduled that there was no room for slack work. There was also no place for "cannon-fodder." The unskilled soldier has disappeared. He must be an expert at something, and all must be expert bomb-throwers.

The only defense possible against this new type of attack is the deep dug-out, or its improvement, the underground fort. Trenches and barbed wire cannot be relied upon as they disappear before a sufficiently heavy fire.

Disconnected forts cannot be held against determined attack, a continuous line must be presented the enemy.

The Verdun attack was successful for the French because they had prepared to the last detail, and put in their best brain work. Their method was not expensive in lives, considering the ground gained, and will undoubtedly become the accepted method of routing out an entrenched enemy. In it lies the technique essential to every attacking army.

—Frontal

See also

INFANTRY—TACTICS—COMBAT

—Night

See

NIGHT ATTACK

NIGHT OPERATIONS

AUSTRALIA

—Military Policy—Compulsory Military Service

[*Information,* Nov, '16. Partly quoted.]

Pursuant to the decision of the Federal Labor caucus, early in September, the question whether compulsory military service should obtain in the Commonwealth for the needs of the war was submitted by the government to the voters of Australia in the form of a referendum on Oct 28.

The enlistment situation showed that 103,000 reinforcements had been voluntarily enrolled, additional reinforcements needed up to July 1, 1917, were 100,000, and 125,000 men were available, who were "fit, single, and without dependents."

The government's plan was that voluntary recruitment was to be continued; the deficiency to be made up by conscription; men to be called up month by month as required; no compulsory calling up of men under 21 years of age; absolute exemptions otherwise: (1) only sons; (2) single men who are the sole support of dependents; (3) in families which have already furnished volunteers no calling up the remaining members up to one-half; the constitution of non-military tribunals to hear appeals for exemption.

Australia voted against conscription, Oct 28, by a majority of 89,000. Incomplete returns were as follows: For conscription, 798,000; against conscription, 887,000. It was expected that complete returns would show a total of 2,000,000 votes polled. Affirmative majorities were counted in Victoria, West Australia, and Tasmania; negative majorities in New South Wales and Queensland. The attitude of South Australia had not then been determined.

The heavy vote against conscription was said to have been mainly due to three causes: first, to the ingrained opposition in the most advanced democracy in the world to anything resembling coercion; second, to a struggle within the Labor Party for control of the movement; and, third, to the popular feeling in Australia that the war was nearly fought out to victory and that, consequently conscription in Australia was unnecessary.

It does not follow that Australia is luke-warm in regard to the war. With a population of 4,500,000, Australia has furnished over 300,000 volunteers, and more recruits are steadily coming forward. Its troops have fought bravely and suffered heavy losses at the Dardanelles and in France.

AUSTRIA

—Aeronautics

See

AERONAUTICS—MATERIAL

—Army

See also

EUROPEAN WAR—FORCES ENGAGED—AUSTRIA

EUROPEAN WAR—FORCES ENGAGED—CENTRAL POWERS

—Army—Artillery

See

FIELD ARTILLERY—AUSTRIA

MOUNTAIN ARTILLERY—MATERIAL—HOWITZERS—AUSTRIA

AUSTRIA—Continued

—Army—Cavalry

See

HORSES—BREEDING OF—AUSTRIA

—Army—Sanitary Service

See also

EUROPEAN WAR—SANITARY SERVICE—AUSTRIA

—Army—Staff

[Higher Command of the Army of Austria-Hungary. *Revista Militar,* Nov, '16. 3400 words.]

(A description of the staff organization at the headquarters of the armies in the field. Names of important officers are given and their specific duties outlined. An account of the daily routine at headquarters is included.)

—History

See also

EUROPEAN WAR

AUTOMATIC RIFLE

See

INFANTRY—ARMS—RIFLE—AUTOMATIC

AUTOMOBILES

See

MOTOR TRANSPORT

[The English Automobile Industry in Time of War. Anonymous. *Schweiz. Zeit. f. Art. u. Genie,* April, '16. 600 words.]

(Transcript from *Militär Wochenblatt,* 1916.) Statistics from *The Economist,* Jan 22, 1916, are given showing the number of automobiles, motor-cycles and their parts imported and exported during the years 1913, 1914 and 1915. These, however, fail to include the large number of military automobiles, motor-cycles and parts made directly for the British Government and exported either to the different British fronts or to her allies.

[The Development of the Use of Automobiles in East Prussia. From the Allgemeine Automovil Zeitung. *La Guerra y su Preparación,* April, '17. 4000 words.]

The occurrences of the war have fixed attention on East Prussia, and as a result economic questions connected therewith have been studied with great care. Before the war East Prussia was less developed economically than other parts of the Empire. Population showed little increase, and industry little development. One cause was the fact that railroads and canals were comparatively scarce. Traffic in motor vehicles has been similarly retarded. Both in the actual number of such vehicles and in the number in proportion to population East Prussia has stood below the other Prussian provinces. This was due to the agricultural character of the province, to the flourishing industry of horse-raising, to the scarcity of large cities, and to the inferior system of roads. Another factor was the retarded education of the inhabitants. There has been, however, a considerable increase in the number of motor vehicles in the province in recent years.

Until recently motorcycles formed the greater part of the motor vehicles in use in East Prussia. The introduction of motor vehicles for freight has been slow. Motor trucks form a very small percentage of all motor vehicles in this province, as would be expected in an agricultural country. Most of the machines in use are private passenger vehicles. This class of vehicles has had a greater proportional increase than any other. The province is also behind most of the others in business and in public passenger autos.

In some States of Germany, notably Bavaria, Wurtemberg, Baden, Saxony, and Thuringia, regular automobile lines have acquired agricultural importance. These lines receive State aid, and are important adjuncts to the railroads. Such lines would be of benefit to East Prussia, but are almost entirely lacking, due to lack of capital, of experience, of foreign commerce, and of State aid. A few were established in 1913-1914, generally by private enterprise, but in some cases with municipal aid. The total length of these lines does not exceed 100 kilometers, and the average capital invested is 20,000 marks.

After the war there will probably be a great increase in the use of automobiles, due in part to the decrease in the number of horses.

—Armored

See

COAST DEFENSE—BY MOBILE GUNS (Article: "Mobile Armament for Defense")

"TANKS"

[The Belgian Armored Automobile Corps. Anonymous. *Schweiz. Zeit. f. Art. u. Genie,* July, '16.]

Organization.—10 armored cars, 3 observation cars, 1 repair truck, 2 ammunition trucks, 3 supply trucks, 1 motor ambulance. Personnel, 200 men, of whom 12 are motor cyclists and 100 pedal cyclists.

The armored cars are each equipped with two 40 mm. rapid fire guns and 1 machine gun, both able to fire in all directions.

The method of attack is as follows: The cyclists are first sent out in all directions to reconnoitre the roads and the strength and position of the enemy. The motor cyclists are then sent back as agents and to guide the armored cars to the place of attack. The armored cars in moving along the road take up an echelon formation, alternate cars on opposite sides of the road, with 50 yds. distance between cars. Since the beginning of trench warfare only few opportunities have presented themselves to use this corps.

[The Tanks. Editorial. *The Army and Navy Gazette* (London), Sept 23, '16. 375 words.]

At the front on the Somme, something of a very different kind from the armored car used in Egypt and the Caucasus was needed in view of the shell-torn roads and trenches. In the evolution of the tank all the difficulties appear to have been overcome, and this new armored car is immune against anything except a direct hit from a heavy gun. It has surmounted ditches and field works of every imaginable construc-

tion, and has been able to take up a tactical position of real value astride a trench and sweep it on either side by machine gun fire. We can hardly imagine anything better calculated to strike terror to much harassed infantry than, after long pounding by heavy artillery, to see in the dim light of morning these monsters making toward them, accompanied by swarms of British infantry. The result of the use of these monsters has exceeded all expectations; they have triumphed in large measure, no doubt, because they were a surprise.

[Military Committee Hearings. *Army & Navy Jour.*, Jan 6, '17. 400 words.]

The Chief of Ordnance stated to the House Committee on Military Affairs that European war orders were crowding out U. S. army contracts from private plants. He favored fostering these plants.

Most of the $2,000,000 provided for armored motor cars would be expended for 58 armored automobiles, 230 motorcycles with machine guns, and 690 motorcycles with side car carrying riflemen. An experimental "tank" will be built as soon as the design is completed.

Nearly $50,000,000 will be expended for machine guns before 1920, according to present plans. About 17,000 will be purchased in addition to those now on hand.

[Cavalry and Its Auxiliaries. By Col. Avilés. Reprint from *La Guerra Europa. Memorial de Caballería*, Jan, '17. 600 words.]

Armored automobiles and motorcycles armed with machine guns have been used extensively on all fronts. The Germans found them of great value in pursuing the fleeing Rumanians. It is only in this campaign and that of the English in Egypt that they have been used to operate independently of the other arms. The defect of these instruments is that as a rule their action is limited to localities where there are wagon roads. The conclusion is that they would be of most value as auxiliaries to cavalry.

[A Tank in Trouble. *Scientific American*, Jan 13, '17. 400 words. Illustrated.]

Two photographs of a dismantled tank show that the battery consists of four guns, two on each side, mounted in a sponson, a five-sided structure built out from the side wall of the tank amidships. The guns have a field of fire of nearly 180 degrees. The gunners are protected by revolving shields. The forward end of the machine rakes upward at an angle of about 30 degrees, enabling the caterpillar feet to obtain a good grip on the side of a shell hole in climbing out.

[Internationalizing the Armored Land-Ship or "Tank." *Scientific American*, Apr 7, '17. 375 words. Illustrated.]

The "tank," at first considered a passing novelty, has been adopted by several nations and is being developed by them. An American-made "tank" has been tested before United States army officers at Los Angeles. This tank uses the caterpillar-tread propulsion, the body is fitted with a number of loop-holes, and a knife-like prow provides for cutting thru the stoutest barbed-wire entanglements.

The latest French tank is armed with a rapid-fire gun of at least 3-inch caliber, and with several machine guns.

[Quoted from the London *Spectator*, Apr 21, '17.]

From the same source [the *Morning Post*] we may record an acknowledgement of the splendid work done by the tanks. The Germans tried very hard indeed to get to grips with them, but these good-humored moving castles roamed about quite undismayed, destroying small redoubts and other trifles. Like the knight-errants of old, they are always on the look-out for worthy deeds.—Christian and Faithful, it may be remembered, when they had an "off day," roamed the fields in order to see if they could do any good; *i. e.*, pick up a giant or a magician.—One particularly heroic example of the work of the tanks must be quoted. When the tank was in flames, the commander and his men opened the steel door and took their Lewis gun into the open. A detachment of twenty-one Bavarians who advanced and tried to make them prisoners were all killed. The officer and his companions afterwards made their way back unhurt. Another tank toured the Scarpe marshes for nearly two days, and having exhausted all its ammunition, amused itself by bursting in little concreted shelters. It then came contentedly home again. Finally, we hear of a group of tanks which arrived in one enemy-held village two hours before the infantry, destroyed all the machine-gun emplacements, killed many of the enemy, and then sat down in the High Street till the supporting battalions came up.

["Tanks." Compiled by Mr. H. E. Haferkorn. *Professional Memoirs*, July-Aug, '17. 700 words.]

(A list of thirty-eight references to articles in current periodicals on the subject of military tractors, "tanks" and armored cars.)

[Tanks. New Corps to Be Formed. *Army & Navy Gazette*, Aug 4, '17. 750 words. Table.]

Army orders of July 28 authorize the formation of, and provide rates of pay for, a corps to be entitled "Tank Corps." Technical and non-technical personnel is provided for. The non-technical personnel has the same pay as corresponding grades in the R. F. A. Units will be the same as at present approved for the heavy branch of the Machine Gun Corps.

It is provided that officers be obtained by commissoning selected cadets from the Tank Corps Officer Cadet Battalion and by transfer from the Regular, Territorial, and Reserve Forces, and New Armies. Promotion is lineal in the Tank Corps. Qualification will be passed upon by a board at the Tank Corps Training Center.

[When the Gasoline Cavalry Charges. *Scientific American*, Aug 4, '17. 1600 words. Illustrated.]

AUTOMOBILES—Continued

The French started to build tanks when the British did. The British used the tanks first in the battle of the Somme, and the French not until Gen. Nivelle's attack on April 16 last. The French delay may have been due to lack of faith in their utility, but more probably because they were not ready.

The French tanks differ from the British radically in design and appearance. They were more on the line of a square steel box with a ship-like bow and a slanting cutting member. On May 5, a larger and more powerful French tank made its appearance, known as the St. Chamond type. It has three turrets forward and has a long range q. f. gun which fires thru a port-hole in front. The St. Chamond tank is of great power and in a recent test was successfully driven thru a dense forest.

The tanks have proved of considerable value and were successfully used in the attack on the Craonne plateau, even tho the Germans knew of the impending attack, and had designated special batteries for anti-tank work.

Service in the crew of a tank is as dangerous as that of the aviator or submarine crew. The interior is very cramped, and in addition to the danger, the atmosphere inside becomes almost intolerable and the heat is oppressive. The crews of the French tanks are volunteers taken from all branches of the service.

AVIATIK AIRPLANE

[The Present Day Aviatik. By Jean Lagorgette. *Aviation*, Jan 1, '17. 2200 words. Illustrated.]

In the development of the aviatik tractor biplane, the Germans originally had the wing spread almost double the length of the airplane, but later the wings were shortened, while the length of the body remained the same. The angle of incidence of the wings to the propeller axis is about 4½ degrees. The wings themselves have a very slight dihedral and are practically rectangular in shape, the sweep-back being a trifle more than one degree. The spread of the upper wings is 40 feet; lower wings, 35 feet; chord, 6 feet 1 inch; gap, 6 feet 4 inches. Ailerons are fitted only to the upper planes and their rear edges rise progressively near the ends of the wings. Each aileron is 7 feet 3 inches long by 2 feet 5 inches wide. The tail has a large fixed stabilizer; in shape it is almost a perfect half circle and is slightly lifting. The elevator is composed of two semi-oval surfaces between which the rudder is pivoted. The rudder is semi-circular in shape with a triangular shaped fin. The elevator, the rudder and fixed vertical fin are built up of hollow steel tubing .47 of an inch outside diameter. The stationary stabilizer is also built up of steel tubing but of .98 of an inch outside diameter. The ribs in all cases are wood. The body is 11 feet 6 inches long. It is built with box girder construction, rectangular in cross-section and diagonal stays of steel wire. The body has a good stream-line form, more slender than it formerly was. The body is 11 feet 6 inches long. It is built with rear uprights slanting backward in order to facilitate the working of a machine gun. The passenger sits on a folding seat level with the wings, between the main gas tanks. In this position it is not believed that his range of vision is increased, while he is certainly poorly protected from the wind. The pilot is comfortably seated in a willow arm chair which is velvet upholstered. The four main longerons are of ash wrapped with fabric. The joints are beveled and wrapped. The four longerons retain their maximum thickness right up to the bow, where the bed for the engine is supported by two cross members. The top of the body is covered with arched plates made of aluminum. The rest of the body is covered with fabric. There are folding steps inside, none outside. The landing gear is composed of two V's of elliptic tubing well spread outward and with two supporting members connected at the bottom by a round tube fitted with wooden stream-line members. Due to the lack of rubber, the shock absorber is made up of three long spiral springs, set one inside of the other. Tail skid is of the usual type. The Dep control has apparently been adopted for use in the Aviatik machines. Rudder bars have heel rests made of metal tubes. On the right and left, in front of the pilot, are two bomb-launching tubes. The launching trigger is provided with a spring and the passenger fires it by pulling a cable. On the right of the passenger's side mounting for a machine gun is provided. The gun is so located that it can be fired directly to the rear. The radius of fire seems to be any direction to the rear of the vertical plane, passing by the rear edges of the wings and also forward, except thru the radius of the cone determined by the propeller. Normally the Aviatik carries two machine guns, one on each side of the passenger. The maximum speed at sea-level is 82 miles per hour, minimum speed 49 miles per hour, maximum speed at 2000 meters 74 miles per hour. It climbs 3000 meters fully loaded for four hours' flight, in 47 minutes and 30 seconds. The maximum height of the machine, according to German pilots, seems to be about 15,750 feet with an observer and 18 gallons of gasoline. The Benz and Mercédès motors of 220 horsepower are used.

AVIATION

See
AERONAUTICS

BADGES

See
UNIFORMS—INSIGNIA

BAKERIES

See
KITCHENS, MILITARY—BAKERIES

BALKAN WARS

See
RUMANIA—HISTORY

BALLISTICS

See
ANTI-AIRCRAFT ARTILLERY—BALLISTICS
BOMBS—AERIAL—BALLISTICS OF
FIELD ARTILLERY—RANGE FINDING—BALLISTICS
TRAJECTORY

—**Determination of Data—Apparatus for**

[Notes on Experimental Ballistics. *Memorial de Artilleria,* Madrid, Aug, '16. 1500 words, plates and drawings.]

This paper discusses an article in *Artilleristische Monatshefte* describing a new photographic method for studying the flight of projectiles in the air from the instant they leave the muzzle until the moment of impact. The apparatus is operated electrically and the firing is done at night, the projectile carrying an illuminating device. The projectile is studied thruout its flight, its time of flight, angle of inclination, the effect of rotation, angle of fall, etc., all being obtained.

—**Exterior**

[Motion Pictures of Projectiles in Flight. By Hildebrand Freih. von Cles. Translation. *Jour. U. S. Artill.,* July-Aug, '17. 3000 words.]

This article explains how successful motion pictures have been made of a projectile in flight in daylight or artificial light. By means of a special moving picture machine the following elements may be determined:

a. Determination of the position of the axis of the projectile in space at the muzzle and near the target.

b. Measurement of the initial and terminal velocities.

c. Measurement of the angles of projection and fall.

d. Phases of the projectile on its exit from the bore.

—**Of Penetration**

[Resistance of Armor Plates. *Revista de Artilharia,* Dec-Jan, 1916-17. 4000 words and 2 tables.]

(A mathematical discussion of ballistics of penetration, using the well-known formulas. To be continued.)

BALLOONS

See

Dirigibles
Hydrogen—Production of—For balloons
Kite balloons

—**Captive**

[Aeroplane *vs.* Captive Balloon. By a French Officer. *Flying,* Jan, '17. 1100 words.]

The captive balloon has a dangerous enemy in the airplane. When the weather is clear and the clouds high the airplane is not a formidable enemy. The telephone signal and white puffs of smoke from the 75's bursting give warning from afar. If the balloon is too high it is hauled down 300, 400 or 500 meters. If the balloon is at an unknown height it is impossible for the aviator to calculate the instant to let fall his projectile. When he descends low enough to attack with his machine gun, he must risk being hit by the observer's gun fire and the machine gun below the balloon. Descending to 2000 meters is dangerous for the aviator, but there are some exceptions. Last March, in ideal weather an airplane was signalled approaching. The white puffs of the shrapnel high in the sky could be seen but the airplane itself was not visible. Later the airplane was seen making right for the balloon. A crew started to haul the balloon to the ground. Machine guns and muskets were trained on the airplane. The airplane descended with great daring to the same height so that it was difficult for the anti-aircraft guns to regulate their fire, and only the machine guns were used. The airplane came so close to the balloon that it was thought it would be caught in the maneuvering rope. The aviator attempted to launch an incendiary bomb. Finally a French aviator, who had seen the struggle from afar, flew to the rescue. The observer in the balloon was not wounded but the basket and envelope were riddled with bullets. Such a bold attack is exceptional. Ordinarily they choose a day when great clouds form in a layer above the balloon two or three thousand meters high, when the aviator descends thru a rift in the clouds, releasing his incendiary bombs, covered with fishhooks, which catch in the envelope and are sure to set the balloon on fire. Experience has taught never to allow the balloon to rise out of sight above the clouds. The observer is always protected by a parachute which he fastens to his back by stout suspenders. If he finds the balloon on fire or if warned by the telephone from the ground he jumps, the parachute, folded in a special sack, opens at less than 60 meters, landing him gently on the ground. On one occasion, during a violent wind storm, the rigging broke, and two seconds later the basket started to fall. Instinctively the observer saw his danger, gathered up his papers and jumped into space, descending with his parachute to the ground. Occasionally the wind blows so strongly that it keeps the balloons on the ground. On one occasion a balloon was sent up when there was no breeze blowing. Later clouds were seen forming in the distance. Rapidly the sky became overcast and in an instant the balloon started away and an order was given to pull down the balloon. Two hundred meters were wound on the drum and a thousand still remained. The winch puffed and labored and finally stopped altogether. The pressure was raised. The windlass turned slowly and again it stopped. With everyone at the ropes, two hundred meters more were hauled in when the men walking away with the rope were blocked by a large farm building and had to halt. The pressure in the steam-winch was again raised and the winch began to turn. Hopes rose but the wind rose too. The rope jumped the groove of the pully, jammed and the winch stopped. The basket sways, capsizes and swings like a stone in a sling; to its occupants it seems as if one more jerk will be their last. The basket tosses in the air, the stabilizing wings of the balloon are torn off; the ballonet ripped into shreds diabolically whipping the air. One after another the strands in the cable break. The balloon, freed from its leash, leaps into the air, the light car swinging below. It is a tragic moment. The balloon is finally brought down by fire from the enemy's line and the officers made prisoners.

BANDS, Military

[Military Music. By José Rutá. *Rev. del Círculo Militar,* Jan, '17. 1000 words and two musical compositions.] (To be continued.)

(Gives proposed organization of the musical personnel of the regular (permanent) army; formation

BANDS, Military—Continued

of an infantry band on the march; insignia to be worn by the different classes of musicians and to designate the assimilated rank of musical inspectors, directors, sub-directors, etc. Describes in detail the duties of the Inspector of Music and band leaders, qualifications for these positions, method of selection and scope of examination (practical and theoretical) to which candidates should be submitted.)

Band leaders now in service and not possessing diplomas should be examined in harmony, instrumentation, composition and execution, and those who are found not properly qualified should be required to follow a special course of instruction to be prescribed by the Inspector of Music.

BARBED WIRED ENTANGLEMENTS

—Destruction of

[A One-Man "Tank" for the Barbed-Wire Cutter. *Scientific American*, Apr 14, '17. 320 words.]

The French have introduced a one-man armored vehicle for wire-cutting. It consists of a light steel body large enough to hold a man, and is fitted with two wheels. The man's legs project at the rear, and his knees crawling on the ground furnish the means of locomotion. The operator can use his cutters or even a weapon thru two loopholes, which are provided with pivoted covers for protection.

—Electrification of

[The Electrification of Wire Entanglements, *Memorial de Artilleria*, Madrid, Aug, '16. 500 words.]

Wire entanglements (either smooth or barbed) constitute to-day one of the best obstacles in defensive positions; in order further to perfect them, the idea of charging them with electricity is again being tried, both by the French and Germans. The Russians tried the same thing in the siege of Port Arthur but the results were not satisfactory. The Germans are using a voltage of 500 or higher.

This device has been applied also to neutral boundary lines, prison and concentration camps, etc.

—Use of in European War

See

MACHINE GUNS—USE OF IN EUROPEAN WAR
(Article: "Machine Guns and Barbed Wire")

BARLOW AERIAL TORPEDO

[The Barlow Aerial Torpedo. *Scientific American*, Jan 13, '17. 150 words.]

In successful tests of the Barlow Aerial Torpedo conducted at the Mineola aerodrome, the torpedo was dropped from 2000, 3000, 4000, 5000, 6000 and 7000 feet. In two of the tests light charges of high explosives were used, rocking houses within a radius of four miles. The torpedo is seven and a half feet long and weighs about 100 pounds. Normally inert, it arms itself after it has fallen 300 feet, and detonates at a given point automatically, regardless of the altitude from which it may be dropped. The torpedoes are carried in traps below the airplane, and are released by the moving of a small lever when the sights register on the target.

BARRACKS

See also

BILLETING

[Military Barracks. By Ramón Luis Mendez. *Mem. del Ejército* (Chile), Sept, '16. 1400 words.]

Thru different sources, the Government of Chile has been given several tracts of land, on which to build quarters for troops.

It is hoped that the lack of system which has heretofore characterized the methods employed in the construction of barracks, thereby causing waste of public funds, a total disregard of the needs of the army and resulting in unsanitary buildings, will no longer prevail.

The custom of permitting commanding officers to employ soldier labor for building barracks should not be permitted. This is a pernicious habit. It is not proper to devote the time intended for military instruction of the conscripts to teaching them how to make adobes, bricks, walls, etc.

The separate barracks plan, devised by the French engineer Tolet, is the one that should be adopted. In changing stations of organizations it should be arranged that these transfers are made with organizations of the same branch of the service. We have seen a cavalry regiment ordered to a station formerly occupied by an infantry regiment, necessitating the erection of additional improvised buildings. Such a policy is nothing but an unnecessary waste of public funds.

[Quartering and Provisioning Coast Defense Garrisons in Time of War. By Capt. John S. Johnston, C.A.C. *Jour. U. S. Artill.*, Sept-Oct, '16. 4000 words.]

This question involves more than providing shelter and supplies, it includes as well the security and safety of the garrison and of its supplies. For unless the garrison be able to live within the defenses, while the latter are under fire, it is obvious the defense must fail.

The conditions under which the garrison will live in time of war will be governed, to a large extent, by whether the defenses be organized as fortresses or forts. In the former case the landward defenses will be located at such distances that the coast defenses cannot be reached by hostile fire from the land side, and no special protection against such fire is necessary. The problem of supply devolves upon the fortress staff. But in the latter case, the land defense lines for each fort are brought close in and include only the defenses of that fort. Protection must be provided against fire from both land and sea, and each separate fort must be prepared to maintain itself within its own lines.

We should be lacking in our duty did we not make full use of what we actually have, rather than wait for some other person to furnish us what we think we ought to have. Therefore steps should be taken in time of peace so to organize our defenses that we can hold them with what we know we will have in time of war.

One of the first things to be considered is the maintenance of the garrison, since without the men the guns are useless. Two requisites are indispensable: shelter from hostile fire, and unfailing supplies of food and water. The solution of these problems depends upon local conditions, but they should be studied in time of peace, and measures should be put into effect to meet all conditions in time of war that can be foreseen.

In providing shelter for the garrison, it must be remembered that the garrison must remain within a restricted area near the fixed positions of their defenses; it must always be able to man the armament; and must continue to live and perform all functions of life. The troops should be quartered within a reasonable distance of the armament to which assigned, in quarters securely protected against hostile fire, and furnished with every modern convenience for comfort of the men. There should be covered communications with the batteries and with supply and food magazines. Barracks securely sheltered from hostile fire should be provided and camp facilities should be resorted to only when no better are obtainable. Special attention should be given to kitchens and the means for preparing food.

The plans for quarters for the troops should include plans for caring for the sick and wounded, for dressing stations near the batteries, and for covered communications with the hospital which should be some distance from the works.

The security of the food and water supplies should receive the same careful consideration as is given to the quarters for the troops. Protected supply magazines should be provided, secure from hostile fire, and connected by covered ways with the quarters of the garrison. At least thirty days' supplies should be on hand at the outbreak of war. The source of water supply must be within the land defense lines. If no natural source of supply is available, then a plant for distilling sea water should be installed in time of peace. Everything connected with the water supply must be protected against hostile fire from every direction.

In preparing these plans, it is well to remember that the initiative lies with the enemy, and that we cannot prevent him, with certainty, from undertaking any operation he may choose which is not precluded by the features of the terrain, and also that we must be prepared to meet any form of attack which is humanly possible.

BATH TRUCKS

[The Bath Tub at the Front. *Scientific American,* Apr 14, '17. 200 words. Illustrated.]

So perfect are the sanitary arrangements of the leading European armies that it may be stated without exaggeration that a soldier at the front can take his bath under almost normal conditions. The traveling bath caravan is typical of the bathing facilities. It consists of a truck which carries a dozen or more bath tubs, a water heating plant, and a rolling tent. For use, the bath tubs are taken from the truck and supplied with hot and cold water thru flexible tubes.

BATHS

[Bathing Facilities for Soldiers at the Front. *Modern Hospital,* Sept, '17. 1000 words. 1 plan.]

(Comments on an article by Lt. Col. C. C. McCulloch, U. S. Medical Corps in the *Southern Medical Journal.*)

The bathing habits of the regular soldiers are good, but untrained troops in the field often neglect the simpliest rules of hygiene.

The Russians have apparently paid most attention to the bath question, and were the first to attempt to solve it. Bath trains of twenty cars were provided. The locomotive heated the water carried in two tank cars. The balance of the train comprised undressing cars, bath cars, disinfecting cars, etc. The hut method was also used by the Russians, the hut having preferably two rooms, one for a dressing room and the other for bathing. About 700 men can be bathed in a day in such a hut. The bath room is heated by stoves with serpentine stove pipes, over which, when heated red hot, water is poured.

A pit shower consists of a pit about 20 feet in diameter paved with brick and covered with sheet iron sodded over. A boiler on the roof supplies water thru sprinklers over tubs.

Another form is a circular tent 23 yards in diameter with a smaller bath tent inside. The circular corridor is partitioned up into compartments for dressing, sterilization, and laundry, barber shop, etc. The central bathing tent is floored with corrugated iron sloping to a central drain and covered with a wooden grating. The corridors are heated by stoves, and the bath tent by the water heater. A Russian regiment of 4000 to 4500 men can be bathed in two days or less by such a plant.

One form of bath used by the French is a transportable shower bath costing about $100, weighing about 330 lbs., and serving 250 to 500 bathers in six hours. It is difficult to adapt it to winter conditions.

The latest English bathing method is described in the *Journal of the Royal Army Medical Corps* for September, 1916, and pays attention to separation of soiled and clean parts. A portable frame building (plan shown) provides an entrance, undressing room, soiled clothes room, whence the bathers pass to the showers and emerge thru an issuing lobby to a dressing room connected with the clean clothes room, and thence from the building. There is an ironing room and table across the front of the building. The rear third of the building in plan is occupied by the boiler room with tank, the men's showers, and a separate shower bath for officers. The latter has a separate entrance on the side of the building.

BATTLESHIPS

—Comparative Power of

See also

UNITED STATES—NAVY

[The Most Powerful Modern Battleships. Anonymous. *Schweiz. Zeit. f. Art. u. Genie,* May, '16. 1000 words.]

BATTLESHIPS—Continued

Until recently the six English dreadnaughts of the *Queen Elizabeth* class were the most powerful battleships afloat. These are now surpassed by the four French dreadnaughts of the *Duquesne* class. Whereas the former carried two 38 cm. guns to a turret, the latter carry four 34 cm. guns in each turret. The following objections have been made to more than two guns in a turret: Accuracy is sacrificed; a chance shot will put more guns out of action; unfavorable distribution of weight on the ship.

The proponents of the four-gun turrets maintain that: the probabilities of a direct hit on a turret is less by reducing the number of turrets; even tho one turret is put out, this will be compensated for by the greater number of guns which this method permits; placing twelve guns in four turrets saves more weight than placing the same number in six.

The broadside of the two types is: *Queen Elizabeth,* 7422 kg.; *Duquesne,* 9130 kg., some even say it is 11,277 kg.

Displacement and speed: *Queen Elizabeth,* 28,000 tons, 25 knots; *Duquesne,* 29,500 tons, 23 knots.

Eight new dreadnaughts of the *Queen Elizabeth* type have been authorized in England, but with only 26,200 tons displacement and 21 knots.

[Large *vs.* a Greater Number of Smaller Battleships. By Lieut. Commander Thomas Lee Johnson, U. S. N. *Proc. United States Naval Institute,* July Aug, '16. 14,000 words. Diagrams and tables.]

(This essay was awarded the prize of $1000 offered by Mr. Walter Lippincott of Philadelphia, for the best essay on the subject, "Large vs. A Greater Number of Smaller Battleships"; that is, would the defense of our coast, and incidently aggressive action, be better provided for by the expenditure of a given amount in the construction of the largest type of battleships or in more of smaller size.)

"Large and Small," especially with reference to battleships are certainly relative terms.

A large battleship is one that embodies more fighting strength than any built or building by a possible enemy, and conversely, for a smaller battleship.

A careful analysis of the subject bars a full academic discussion by the very statement of the proposition, viz.: "would the defence of our coast, and incidentally aggressive action be better provided for?" In other words the discussion must deal with battleships built for a particular purpose and not with the general question of large ships against small ones.

Were the United States properly organized for defense, the type and number of battleships as well as other military units would be the logical result of the correct estimate of the military situation. Our statesmen, and especially the President, the Secretary of State and Congress, would determine and fix the policy of the nation. This policy would express national aims, aspirations and fears. At present this policy embraces the following tenets: (a) the Monroe Doctrine; (b) the protection of the Panama Canal; (c) the maintenance of the rights of neutrals; (d) the exclusion of Asiatic races; (e) the Open Door in China.

Knowing the policy of the nation, our probable enemies would be determined, their racial characteristics and military strength, also the probable areas of war, the kinds of campaigns, and the necessities for pushing to a successful issue the defence and safety of the United States. Such issues should determine the policy of naval construction.

Taking the situation as it exists, tracing in detail the development of the recent building programs of the great world powers, and drawing conclusions from the great naval engagements of the present world war, we are led, after a comparison of calibers, to conclude that for a given sum of money we should build large battleships more powerful than those building by any other nation, for the following reasons:

(a) The first cost and the maintenance per unit of military power vary inversely with the size of the battleship.

(b) Both tactically and stragetically the large battleships are superior.

(c) Large ships engender the most desirable virtues in the officers and men who conceive and man them.

(d) The national policy demands large battleships.

[Battleships. By Commander Ralph Earle, U. S. Navy. *Proc. U. S. Naval Institute,* Sept-Oct, '16. 12,500 words. Diagrams and plots.]

(The discussion deals with the question of large vs. small battleships and covers the field of the article in the July-August number, *Proceedings Naval Institute* on the same subject. In this instance however the author concludes as follows, in favor of smaller battleships.)

(1) Strategy requires the larger number of vessels.

(2) The type of smaller battleships under discussion possesses speed and steaming radius equal to those of the largest type of battleships.

(3) The large battleships are practically as vulnerable as the smaller ones.

(4) A sufficient number of guns of the necessary power of the greatest obtainable accuracy can be mounted upon the smaller vessels to enable them to defeat at all practicable fighting ranges, a smaller number of larger vessels despite the heavier caliber guns of the latter.

(5) In battle, the number of vessels is most important because, by their concentration and volume of fire, the greater number have an important advantage.

(6) By continuing the construction of battleships of not over 23,500 tons displacement, the present units of the battle fleet will be utilized to the utmost.

(7) The waste of displacement and consequently of funds that takes place in the construction of battleships, increases with their size and is much greater proportionately than is any advantage gained thereby.

(8) The smaller ship by reason of its size has many more ports and drydocks available to it for repair and revictualling than has the larger ship. This attribute may most conceivably win a naval campaign that would be lost by the inability of the larger vessel to

return quickly to the battle-line after its retirement therefrom because of severe damage.

(9) Our docks, harbors and repair facilities can, with justice, be expected to be maintained so as to provide for the necessities of the smaller ships, whereas to improve them sufficiently to make then suitable for the largest types of battleships is a problem that is extremely costly and improbable of solution.

—Submarine Protection

See also

SUBMARINES—DEFENSE AGAINST

BAYONET

—Instruction and Training

[Bullet and Bayonet. By Lt.-Col. H. Lecomte. *Revue Mil. Suisse,* Sept, '16. 3000 words.]

Many people in Switzerland think that skill in shooting will very nearly excuse in a man absence of other military qualities, because, in their opinion, a good shot is necessarily a good soldier.

A veteran of the Foreign Legion told me that the best shot in his battalion—he was a Swiss too—always managed to avoid an engagement. This crack shot was a coward. At the critical moment, his skill in shooting was of no use because it was not reinforced by courage and a sense of duty.

We must continue to pay attention to shooting but we must also not neglect the rest. By that I mean the moral and material qualities that tend to make a man a soldier. As long as war is made, the most important factor will be the man himself; *the man behind the gun.* If this man lacks courage and discipline, the most perfect rifle and the most modern matériel will not secure him the victory, even if he handles them with skill.

In the trenches to-day, the infantryman uses not only the bullet but also the bayonet, the rifle-grenade, the hand-grenade, the pistol, and the knife, to say nothing of such trench engines as machine-guns, mortars, suffocating gas, liquid fire, etc., which are generally operated by specialists.

The reports which filter from the belligerent fronts are rather contradictory; sometimes, one hears that the infantry hardly fires any more but that it works essentially *a la fourchette;* others leave the impression that the dagger and the grenade become the principal weapons of trench warfare; troops go to the assault without rifles, dagger in one hand, grenade in the other. It is a little difficult for us neutrals to decide how to instruct our infantry in a manner corresponding to the exigencies of modern war.

According to an English officer, the two principal factors in infantry efficiency are physical training and skill with the bayonet.

In trench warfare, the genius of the chiefs loses some of its influence. It is a man-to-man struggle, and subaltern officers, non-commissioned officers and privates have the principal part. If a man is not sufficiently robust and in good training, his health will be quickly ruined and his energy too. Physical vigor is not all, promptness and presence of mind are needed; body and mind must act in concert. Confidence is also necessary; he who hesitates is lost. Training develops these factors.

Everyone must be in training, the officers being exposed to the same danger as the men.

These are principles which no one will contradict but which are often forgotten. Immense progress has been made in this line in our army, but in every militia army training is a recurring task, to be renewed after each period of civil life.

Each belligerent claims that he is superior to the adversary in the use of the bayonet. This is probably because, in cases where the shock actually takes place, the defender is already in a state of moral inferiority and gives ground almost immediately.

Good direction with the bayonet is much more important than a good aim with the rifle. In firing, if you miss your man, you may hit another; besides, you generally have time to fire again. With the bayonet, it is different. If you miss your man, it is probable that he will kill you. You must touch a vital part, the face, the throat, the upper part of the chest, the abdomen, the groin; the bayonet penetrates these parts easily and comes out easily. A bayonet planted in the shoulder blade, for example, can be pulled out only by putting the foot against the adversary's body; meanwhile, one is defenseless.

Strength is necessary to plunge the bayonet in and pull it out quickly. Speed is important. The trench must be cleaned out quickly before the counter-attack.

A great general used to tell his soldiers to "think in terms of the bayonet." It is still better to practice with that weapon. Half an hour a day is sufficient. It is the duty of every officer to learn to use the bayonet so as to be able to defend himself in hand-to-hand fighting.

The bayonet is not yet scrap-iron, and the infantryman should learn to use his rifle as a weapon of shock as well as a firearm.

Should he also learn to use the grenade and the dagger? I do not think so. I think that special detachments of grenadiers and close-in fighters will be formed, much like the specialists in machine guns, telephones and signaling.

What we want is infantry trained to bear hardships and trained in killing, not only from a distance but close to. The bayonet must be cultivated more, without, however, neglecting shooting.

[Bayonet Fighting and Physical Training. By Maj. Percy Hobbs, Canadian Forces. *Infantry Jour.,* Aug, '17. 4200 words.]

The present war has shown that modern science has not done away with hand-to-hand fighting and success in battle may still hinge upon the use of the bayonet.

The first Canadian troops received no bayonet training and but perfunctory physical training, but the last 150,000 received training as hereafter described before going overseas, and the training was continued in England. In France, it is never allowed to lapse except when troops are in the trenches or actually fighting. Bayonet and physical training are quite as important

BAYONET—Continued

as munitioning, rationing, or special training in the general efficiency of troops.

Physical training is for the general welfare of the men, a daily hour with the mouth shut and the pores open. There should be 20 instructors and one staff officer per battalion, so that all the physical training can be given simultaneously in a single period. If fewer instructors are available, a time-table must be worked out giving each instructor groups of 30 to 40 men consecutively. One instructor can handle according to necessity 4 to 8 groups per day.

What is wanted in France is men who cut their hair short, shine their buttons and salute their officers, have their eight tables of physical training and the five bayonet fighting lessons done with, can march 20 miles, and if they can shoot (rapid fire) so much the better. Bombing, trench warfare, and even musketry, can be better taught abroad. When the recruit is physically fit, he has learned how to learn, and he is then ready for the fourteen weeks of training in musketry, bombing, trench warfare, etc., and more especially is he ready for the bayonet training.

The Swedish drill consists of eight progressive tables of exercises for recruits, two for trained men, and some short exercises for orderly room workers. In the latest tables, 30 per cent of the exercises are especially selected and arranged with reference to bombing. As the tables of exercises now stand, they have direct reference to bayonet fighting, bombing, and drill movements generally, but still with a view to symmetrical general development.

Elementary physical training is very difficult to give. Good natural instructors must be selected and then carefully and systematically trained. The training must have continuity—six days a week with 90 per cent of the strength present, and not 30 per cent one day and 50 per cent the next. Without continuity the instructors will lose snap and the men interest. It takes a month for the staff instructor to train 20 instructors. Five months later the units trained by them could go over the bayonet fighting assault course in style 800 strong.

In a volunteer army, the worthless officers are not weeded out as soon as they should be. Results should be required as in civil life on a building job. A soldier's time costs the government money, and he who wastes time indirectly works for the enemy.

The physical training of the British army is controlled from Headquarters Gymnasium, Aldershot. It is devised by experts and revised from time to time, with frequent refresher courses for instructors to keep them up to date.

In our (Canadian) branch, good non-commissioned officers are selected for instructors and given a 21-day course. They then return to their units and are used for a month, when, if they show promise, they are given a second 21-day course at a headquarters school. Then they return to their units and, if they make good, in about four months they receive their badges.

In raising new units in large numbers, it is difficult to find enough non-commissioned officers who show promise as physical training instructors, so the reverse process of selecting good physical training instructors and training them as non-commissioned officers at a special training depot is being tried. The n. c. o. course in this case is six weeks.

Bayonet Training. Bayonet training is largely a matter of fighting spirit, and the job of instructor is more to arouse this spirit than to impart information.

The physical training instructor must be found and trained. About 5 per cent of the men who enlist could be made into such instructors. Actually about 2 per cent of the infantry take the 21-day course, and about half of these become physical training and bayonet fighting instructors. These figures apply to conditions in Canada, where reliance had to be placed in finding and using natural talent. There would be less difficulty where there were experienced non-commissioned officers to draw on, as in England.

Bayonet fighting rests upon the fighting instinct and can only be practised in use upon an enemy. The instinct of hand-to-hand fighting has not been cultivated in Canada in recent years. Personal combat, which is at the bottom of good bayonet work, can be taught best to English-speaking people by boxing, which is more generally known and understood than fencing.

A course in bayonet instruction comprises five lessons of three practices each, and covers positions and movements, guards, parries, long points, short points, jabs, and rough-and-tumble fighting. The first practice is movement by word after explanation. The second is movement by eye in opposing lines, taking time from opponents' movements. The third consists in striking bags, parrying poles, etc. These practices can be concluded in 15 hours of training. Then follows the bayonet training on the assault course or training ground, comprising trenches, suspended dummies, prone dummies, and many of the special features to be encountered in trench fighting with the bayonet. Charging in line over trench systems with dummies follows later. All this training tends to establish confidence and makes the men game to close with the enemy. In the real thing, the average men forget their training and grapple.

In hand-to-hand fighting, it is necessary to keep one's head. A slight advantage in skill will give the victory. The Russians are excellent at bayonet fighting, and the Bulgars are the best in the world.

There are an average of half a dozen fighters in every company. With the aid of boxing gloves, these can leaven the company. A finish fight with the gloves is a good experience for any one, and such a fight (author's opinion) is an essential part of an infantryman's training. Boxing is an essential supplement to bayonet training. By using several officials, two-minute bouts and two-minute rests, pairs alternating, a large number of bouts can be run thru at the average rate of five minutes per couple in each ring.

[New Principles of Bayonet Fighting. By André Gaucher. *Marine Corps Gazette,* Sept, '17. 6000 words. Photographs.]

Experimental methods cannot be relied upon for the training of soldiers in bayonet fighting. There is neither time nor opportunity for this, so it has been necessary to develop a method, simple and rational, which would enable soldiers to be trained efficiently and rapidly in the duel with the bayonet. All along the front, series of groups, each composed of two men, face each other, and victory hangs in the good or bad issue of these individual duels.

A good method of bayonet fighting consists in very simple principles of fencing, based on a few aggressive and swift strokes. The method described is based presisely on the peculiar use of the stroke called the "*lancé,*" which combines to a high degree this double quality of aggressiveness and swiftness.

In former methods there were two serious errors: the use of lunging, which properly belongs to fencing with one hand, and the defective position of the left hand. In the new method these drawbacks are done away with by changes in the position of guard. The left hand is placed above the band, thus distributing the weight of the rifle equally between the two hands, and the lunge is discarded as impossible for use in bayonet fencing. With the use of the rifle knot the *lancé* becomes a stroke of great precision and swiftness, almost beyond parrying. The rifle knot or *dragonne* is made of flexible leather or heavy web and is shaped like the figure eight. A small loop encircles the small of the stock while a large loop goes round the wrist of the soldier. This device does away with the fear of losing hold of the weapon, either because of the violence of his blow, or because of the shock of the adversary's parry. The conviction that under no circumstances can he be disarmed, gives great confidence to the soldier, and enables him to concentrate his attention on his opponent. Besides this, many rifles are saved which would otherwise be lost. It is easier to withdraw the weapon from the body of the opponent and the hand can be freed instantly.

In the position of guard the rifle should be held slightly below the horizontal, a little lower than the level of the cartridge box; it should be free of the body, the muzzle pointing slightly to the left, the right hand should be kept at the small of the stock, and the left above the band; the feet should be planted about a foot apart, according to the man's height, the conditions of the ground, and those of the fight. The rifle is well balanced and ready to be darted like a javelin. The left hand follows the rifle as far as possible when it darts forward to its object.

To execute the *lancé* take a position of short guard, about twelve inches between the feet, with the legs and hips bent very low. Launch the rifle forward with both hands, the legs, hips and right shoulder being simultaneously unbent to their full length. The left hand must follow the rifle as far as possible without hindering the circular movement of the body from right to left. The left foot should be moved eleven inches forward, and the left hand be held ready to regrasp the rifle, when the blow is delivered, at the instant when it is pulled back by the right hand to the position of guard.

Altogether there are four important strokes in use in bayonet fighting. Enumerated in the logical order of fighting they are the *lancé,* the *parade,* the *pointé,* and the *poussée.*

To execute the *parade,* or parry, both hands should be used. The strong unbending of the hips is carried on by the semi-circle usual to the parry; it is executed either from downwards up, or from upwards down, on the side on which the attack is directed.

In the execution of the *pointé,* the rifle should be smartly thrown to the front with both hands, the body leaning foward. The left foot should be brought forward, six to eight inches, without any lunge.

As a rule, the *pointé* should not be used for attacks, as its offensive power is small unless executed with a lunge and then it becomes very difficult and dangerous. The *pointé* is most advantageously used after a parry, as a back thrust, or as a block on the *butt-stroke.*

The *poussée,* or push, is the quickest means of disengaging when the stocks are in contact. It consists in a sudden jerk given from the hips so as to get a violent push. If this does not throw the opponent, he is at least hurled back sufficiently to allow a *lancé* or a *pointé* to be aimed at him.

If the adversary is a heavy man one should take on him a point of support for making a short step backward, before the *lancé* or *pointé* is attempted. If impossible to disengage, the stock must be used to give short ramming blows aimed at vulnerable spots. The use of the butt is reserved for close fighting and should not be relied upon against an attack by an opponent familiar with the use of the bayonet.

A bayonet duel is composed of three periods, as follows:

First period.—Under all circumstances the fighter should try, as soon as he has judged his distance, to be the first to attack. For this the *lancé* should be used by preference, because of its power and swiftness and its great advantages of carrying further.

Second period.—If the attack fails, or proves insufficient to bring down the opponent, a second *lancé* must be executed. If the attack is parried, the attacker must be ready to parry the return thrust, and to deliver a counter thrust, either by *lancé,* if the distance has not been changed, or by a *pointé* aimed while moving slightly forward.

Third period.—Following the attack of the first period, and one or the other alternatives of the second period, comes close fighting or a hand-to-hand fight. One should rapidly disengage oneself from it, using the *poussée* by preference. Then one should renew the attack at once with a *pointé* or a *lancé.*

BELGIUM

—Army

[The Belgian Army in Campaign. By Lieut. E. van Erde. *Rev. Mil. Suisse,* May and June, '16. 9500 words. Illustrations.]

BELGIUM—Continued

I

Before the war the general impression was that not much was to be expected from the Belgian army. The German military party did not rate the resisting power of Belgium very high, their plans and the means of their execution prove that. The majority of the Belgians did not expect much of the army, and that is not very surprising when one considers the opposition to a large armament. A large party was in favor of having only a large enough force to police the frontier in case neighboring nations were at war, as had been easily done in 1870.

King Leopold II was anxious to have the army recognized, and on the very day of his death, signed the bill relating to its renovation. Among those who had resolved to save their country whether it would be saved or not, was Baron de Broqueville, the present Minister of War. Against general indifference, the repugnance of the people for barracks and military duties, and the strong resistance of the politicians, he finally succeeded in getting the law passed.

The Belgian Army Before the War.—Some time before the war, the Belgian army was in a sad condition. Officially, the active army was supposed to be composed of 100,000 men. In time of peace, the strength was 42,500 men, or about 1/180 of the population of the country.

In reality, the actual number of men with the colors was much less. Frequently, it was less than half what it was supposed to be. For financial and other reasons, furloughs were almost obligatory. Companies frequently went to drill with 15 or 20 men.

The men were ill-instructed because the repeated furloughs interrupted their training, sometimes absorbing as much as a third of all their service.

Moreover, interior discipline was extremely lax, on account of the intervention of the civil and religious authorities.

The officers, altho well educated, brought varying degrees of devotion to their profession. Some had come in for the social position, the not very large but assured salary, certainty of retirement, gold braid, in short, a thousand considerations completely foreign to the true vocation of the soldier. They came into the army as into any other public service, into an army which ran no risk of going to war. They had little to worry about, took no responsibility, and drew their pay. They were in a minority as compared to their more zealous colleagues, but they brought, none the less, an element of scepticism and indifference to circles in which enthusiasm and ardor should be the keynote.

Many of these "army employees" were eliminated at the beginning of the operations by the obligatory system of selection, and those that remained were transformed by the stimulus of war, the fact that their country was invaded, and the fine example of their brothers in arms. The material of the field army was of good quality. The absolute lack of heavy field artillery was much felt in the first part of the war. The 75, an excellent piece, could not compete however, with the formidable artillery of the Germans. There were not enough of them, either. At the beginning, there was a total of 324 pieces; the complement of a German army corps, with its reinforcement in guns. There were not enough machine guns, only 120 recently acquired Hotchkiss and Maxim types.

We shall not go into the subject of fortress matériel here. The fate of the forts is well known, suffice it to say that, at the beginning of the war, it was in a period of transition. The Antwerp ring of forts was being finished; some forts did not have their complete armament.

The *uniform* of the Belgian soldier was unsuitable. Attempts had been made to introduce one less visible and more hygienic, but the stubborn resistance of older officers had made them abortive.

All that, of course, was not calculated to contradict those who did not take the Belgian army seriously.

II

Nevertheless, the part played by the Belgian army in the present war has been considerable. It may be said that its action at the beginning has modified the whole aspect of the war and, very probably, its final issue. Thanks to the resistance of the Belgian troops, first on the Meuse, then on the Gette and the Nèthe, and finally on the Yser, the German strategic plan could not be carried out. The armed intervention of Belgium was the grain of sand that threw out the whole careful mechanism. The forts of Liège and Namur immobilized the enormous wave for twenty days. The Belgian army had in front of it something like 500,000 men during these 20 days, and the Germans lost 50,000 men.

Afterwards, the Belgian rôle was not so preponderant; nevertheless, much aid was given to the Allied cause. Several German corps that would have been useful to von Kluck had to be left in Belgium. The siege of Antwerp itself was not very long (11 days), and it was the heavy siege artillery that reduced the forts. Antwerp was crushed from a distance.

In the effort to reach Dunkirk and Calais the formidable army of the Duke of Wurtemberg (130,000) was launched against the Belgian army, now reduced to about a half of its original strength. For 12 days, the German troops put forth every effort to break the Belgian resistance, but without result. Finally, the inundation of the Flemish plains by the Belgian engineers put an end to the offensive.

Since then the Belgians have played a part commensurate with their numbers. They are on the extreme left and sometimes the English North Sea fleet supports them, like light cavalry acting on the enemy's flank.

Composition of the Belgian Army at the Beginning of the Campaign.—The new military law went into effect eight months before the declaration of war. It seemed a particularly unfavorable moment for the invaded country. However, its campaign began with a real prodigy: its general mobilization was executed with a rapidity that surprised the world. Decreed at 8 o'clock in the evening of July 31st it was completely finished on the 4th of August: in less than four days.

Thanks to this admirable preparation, when the Germans invaded Belgium, they were confronted at the frontier by the available forces of the country. They comprised about 120,000 trained men. During the few days when it was possible, nearly 45,000 volunteers presented themselves; a little less than half could be accepted.

The 120,000 soldiers of the standing army came from 15 classes; they were then almost all men from 20 to 36 years of age. The first eight classes, the youngest, were assigned to the mobile army, and the seven older classes to the fortress troops.

The mobile army was divided into six divisions and a cavalry division. A division comprised three mixed brigades, a regiment of artillery, a regiment of cavalry, a battalion of engineers, a telegraph section, a transport unit, and a group of "gendarmerie." Each mixed brigade was made up of two regiments of infantry, of three battalions, of four companies, of from 150 to 175 men.

The tendency, as the war progressed, was towards decentralization. The smaller units were made self-supporting; so we find, instead of mixed brigades, mixed regiments, and later mixed battalions. This change is particularly marked with the artillery and machine guns. They are split up and form an integral part of the mixed regiments.

The conditions of the present war have given rise to new technical needs which have been met by King Albert's army in a remarkable manner. An instance is the creation of eighty companies each of about 200 workmen, auxiliary to the engineers. Several of these companies have been working for the British and French general staffs for the past eighteen months.

Much of the supply is done by the special corps of water transport.

Almost all the Belgian arsenals and ammunition factories had to be built on French soil. They developed the short range mortar, adopted enthusiastically by the French.

Starting at the beginning of the war with only the 75, the Belgians are now making larger cannon of varying calibers up to 380.

The utility of the Belgian auto machine guns and armored trains has been considerably reduced by circumstances.

A corps of auto-cannon, recently formed, is singularly enough, now operating with the Russians.

In the first months of the campaign, the Belgian army suffered much from the superiority of the Germans in machine-guns. Now, the Belgian corps are, perhaps, proportionally better supplied than those of the other armies. Dogs are still considerably used for drawing Belgian machine-guns. Belgian aviation has kept pace with the general progress.

Some of the Belgian hospitals are situated in Brittany and others on the Mediterranean coast. Much of the evacuation of the wounded is done by boat. The ambulance and sanitary services are functioning very well.

The Belgian uniform has undergone a complete transformation. The color is a combined yellow brown and gray, which the men call color of "beet-earth." The buttons and the insignia are of dull bronze, and the mess-can is of dull finish. The belts, shoes, etc., are of tan leather. There is nothing showy about the uniform, but it is very practical.

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The Belgian soldier is brave. Companies have rushed to the assault with such ardor that positions were carried against the previsions of the general staff and could not be supported.

However, it is especially quiet, calm courage, sure of itself, decided, and unshakeable, which characterizes more particularly the Belgian soldier. If you give him an order to hold fast, he will stick. He does not allow himself to be surprised by the most terrifying novelties, such as 42 centimeter projectiles and asphyxiating gases.

They have tremendous endurance and are remarkable workers. The first battle of the Yser is a striking example of their ability to support all sorts of hardships, including loss of sleep. The general staff knew that these men were exhausted and was in despair. The men had to hold, and they did,—for fourteen days. They lost about 20,000 men out of 50,000.

* * * * * *

However, this admirable soldier has one fault. He is rather ill-disciplined; he avoids the exterior manifestations of respect for rank. He likes to pick the orders of his chiefs to pieces. That is a manifestation of the independence that has always characterized the Belgians. He has to understand what he is doing and the reason for it.

A chief that understands his men can exact anything whatever from them. For this soldier, when he esteems and likes his chief, has for him a boundless devotion. It results from these traits of the Belgian soldier that he can be depended on for perilous missions requiring boldness, resolution, and a clear understanding of the situation.

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At the present time, professional officers are probably no longer in the majority in the Belgian army. Considering this the efficiency in all grades is rather astonishing. There has been a great sifting, of course. Those who can themselves fight make the best leaders. Their men follow them, not from fear nor servility, but from devotion and affection.

The artillery officers are particularly worthy of praise. At the beginning of the war, they had to face an artillery often double in numbers and armed with calibers as large as 210 and even 350 mm., pieces with twice the range of theirs.

They have, in the course of the war, reorganized their army and adapted it to modern necessities.

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In the course of the war Belgium has solved its military crisis in a manner most encouraging to small peoples, notably to us Swiss. While accomplishing its mission, it has been transformed into a perfect modern

BELGIUM—Continued

army. The causes of this phenomenon are to be found, doubtless, in the deeply rooted love of the Belgian for his country and in his desire for vengeance.

The real culprits in the situation of Belgium are the powers who had the unfortunate idea of imposing on Belgium an obligatory neutrality. They forced her to be neutral, they guaranteed her neutrality and inviolability; they took away from her at the same time every warlike thought, every semblance of real independence. That is the real origin of the Belgian torpor from a military point of view.

[Prophecy and Fulfilment. By —n. *Jahrbücher, deutsche A. u. M.*, June, '15. 6500 words.]

In recent years French military writers have published several prophetic articles dealing with the coming war with Germany. The present war has shown these predictions wide of the mark. Two brochures by Col. Boucher, entitled, respectively, "France the Victor in To-morrow's War" and "The French Offensive against Germany" (both 1911) and one by Maj. Civrieux, "The End of the German Empire" (1912) will be considered in the light of subsequent events.

In the first named, Boucher advises France to choose the defensive at the outset, until the opening of a Russian offensive compels the diversion of a large part of the enemy's forces. Then the French can assume the offensive, and hurl the Germans across the Rhine. The main points of Boucher's second article follow.

Germany is warned against the folly of driving thru Belgium, thereby fatally weakening herself in Lothringen. But even without invading Belgium, the Germans will be beaten and driven across the Rhine before the French offensive in Lothringen. Even assuming co-operation between Austria and Germany, the Russian divisions could threaten the German border seriously enough to force the retention of several active corps in that vicinity.

An assumed unity of view-point brings about co-operation among France, Belgium, Russia and England. Yet the harmony of German leadership, in the eastern and western theaters of war and on the sea, is seriously questioned. Other points of German weakness alleged are Socialist opposition to military service, doubtful support from the German principalities, particularly Bavaria, less popular enthusiasm for war than in 1870, and inferior morale of the army (imaginings to which events of the present war have emphatically given the lie.)

As for the course of the imagined war, Russia, after a regular mobilization, will invade East Prussia, and in thirty days will be moving on Berlin. By this time Germany must have precipitated a decisive action in Lothringen and withdrawn the bulk of her strength from that region. Germany has only 19 active corps to put into the field, which France could overthrow with 21 active corps. Belgium will merely defend her neutrality. German attempts to avoid the French defenses on the eastern frontier by passing thru Belgium are to be met by 8 divisions of French Reserves together with Belgian forces. On the Semoy, between Namur and Givet, a German Sedan is prepared. Meanwhile, the French commander-in-chief, confident of his ability to control the relative strength of the opposing forces, seeks the direction for the most advantageous attack. He is convinced that the enemy will not be ready for an order to cross the border before the twelfth day after mobilizing, as his columns and trains would not be earlier available.

Boucher appends to his article a sketch of the positions of the opposing troops, ten days after mobilizathetion. Four German armies, with cavalry extending the right to the Conflans-Etain Road, oppose four French armies with cavalry on the left extending to Etain. The German left extends to the vicinity of Saales, and the French right extends to St. Die.

The guiding principles of the French commander are (1) the strategical offensive, (2) the determination to compel the enemy to follow his lead, (3) strategical and tactical surprise. He selects Saarburg as the objective for the opening attack, because it is too far from Strassburg and Metz for these to affect the action, and because of the preponderance of Bavarians assumed among its defenders, who would presumably offer a feebler resistance. (Note the bloody refutation of this assumption in the actual fighting between Metz and the Vosges.)

The two armies on the right are entrusted with the decisive attack. They will overthrow the Bavarians, cutting their communications with the other German forces, and will get in rear of the German forces at Colmar. Other French forces will continue the offensive northward. Movements toward the east are assigned to active forces; those toward the north to Reserve troops with Belgian co-operation. In sixteen days the 13 active German corps in Lothringen are annihilated by 21 French corps, and in 20 days the country is all in French hands.

Civrieux imagines England, Belgium, France and the Netherlands arrayed against Germany. The British fleet destroys that of Germany at the mouth of the Eider, and the German Empire falls, at a battle in Westphalia. Mobilization is ordered August 17th. The Germans fail in attempt to break thru the line of the Maas, at Apremont. Bordeaux, the mythical French commander decides on an offensive campaign, anticipates the invasion of Belgium by the main German force, and conceives the most effective blow to be an attack on the German communications. Realizing that French efforts would collapse against the strong line of German fortresses in Elsass-Lothringen, if limited to the short frontier, he carries the fighting into Belgian territory, with 100,000 Belgian reinforcements, with defeat for the Germans. There follows a smash on the lower Rhine, in co-operation with the British, also the Dutch. All active French troops are in the first line while Reserve and Territorial troops garrison the capital and various fortresses, guard the railroads, and defend the African coast. The English fleet defends the French coast. The French strength is estimated as 800,000 men and 3000 guns. The Germans oppose them with 22 corps, the rest of their forces being required to defend the coast against England.

On the advance of the first German army toward Belgium, with the intention of swinging to the left and operating in Champagne, Bordeaux advances an army on a 40 km. front into Belgian Luxemburg and reaches the west bank of the Ourthe the following day. A British corps is rushed to Namur, and moves against the German right, in conjunction with a Belgian force from Liège. The decision falls toward the east, in the vicinity of Neuf-Chateau.

Civrieux's main theories are (1) that success depends on quickness of decision and action, facilitated by railroad and motor conveyance, by garages along all roads in rear of lines, and by sufficient cars for speedily transferring men from one front to another; (2) that it is folly to contemplate active armies of millions, as it would be impossible to supply them with munitions and provisions, and they would be too unwieldy for quick maneuver.

Comparison with the events of the present war shows the errors in these brochures, viz., the assumptions that (1) the French would initiate the offensive; (2) the Germans would be taken by surprise; (3) the lead would be in French hands; (4) France would open the attack with numerical superiority; (5) the decision would be effected by a turning movement; (6) the decision would fall in Lothringen; (7) a three-fold advance against Germany thru Belgium, and between Strassburg and Metz, and thru upper Elsass would inflict defeat upon Germany.

Instead of surprising Germany, as was attempted by the movement of troop-trains east and north before July 27, and by the introduction of French regiments into Belgium before war was declared, the French were surprised by the rapid invasion of Belgium and the fall of Liège.

Even French official reports show the fallacies of the predictions. The statements in the *Bulletin des Armées* that the French organization needed elasticity to meet whatever direction of activity the Germans might choose; that the invasion of Belgium required the assembling of the main forces in the north; and that the delay of the British necessitated French efforts to hold the Germans in Elsass and Lothringen—show whether the French "held the lead" in operations. The *Bulletin* further shows that while the French had some partial successes at first, against German forces in Elsass, as at Mülhausen, the Vosges, the plains of the Rhine and the approaches to Colmar, misfortunes in Lothringen and Belgium soon necessitated a restruction of operations in Elsass. By Aug 23 the French were retreating. The prediction of French victory, by turning the German left and cutting its communications, contrasts with the actual defeat of the French by superior numbers under the Bavarian Crown Prince.

The predicted overthrow of the Germans in Belgium may be contrasted with Joffre's report. He writes that six or seven corps and four cavalry divisions having broken the opposition at Liège, sought to advance between Brussels and Givet, and extend their front westward. On the arrival of the British near Mons (Aug 23) an offensive was begun toward Belgian Luxemburg. It soon came to a standstill, with heavy losses. The Germans had strengthened their positions; and the issuing and execution of orders in some organizations of the Allies were often unsatisfactory. According to the German report (Aug 23-24) the army of Duke Albrecht of Würtemburg, advancing on either side of Neuf-Chateau, routed an army which had passed the Semoy. An English cavalry brigade was beaten, Belgian troops were hurled back at Aerschot and Tirlemont, and the Germans entered Brussels. The predicted battle on the Semoy was thus a disastrous defeat for the Allies. Joffre's comment, as well as the German official reports of the repulse of eight French and Belgian corps between Sambre, Namur and Maas at the hands of von Bülow and von Hausen, and that of the English army at Maubeuge by von Kluck show that the battle on the Ourthe brought defeat instead of the predicted victory.

Civrieux' secret of rapid decision and action was not appreciated by the military authorities. Conditions both before and after the opening of the war show his short-sightedness in condemning the idea of a war involving armies of millions. Both Germany and France overcame the supposedly insuperable obstacles of unwieldiness and difficulties in provisioning. Even at the time when Civrieux wrote, the French Army numbered 800,000 at peace strength, which would bring it to over a million on a war footing.

The series of defeats disproves Boucher's conception of unity of viewpoint on the part of the French. A former lack in this direction was recognized by the orders issued in 1911 reforming the French staff organization. The army was rid of staff officers and generals unable to render efficient service, and the reorganization was entrusted to Joffre. Those generals who were to command armies in time of war were relieved of purely administrative duties. Each was assigned a Chief of Staff and other subordinates to work with, in time of peace, who should be under him in time of war. Their business was to harmonize efforts in preparation of themselves and their armies for active service, and to co-operate with the Chief of the Central General Staff. The time before the opening of the war was too short for perfecting this work, as testified by Joffre's statement that the war had not brought the results he had expected of it.

—History

See also

EUROPEAN WAR

—Preservation of Neutrality

[The Chiefs of the Belgian General Staff and the Preservation of Neutrality. By Maj. W. Marsily. *Schweiz. Monatschrift aller Waffen*, Sept, '17. 1800 words.]

The Germans have made use of the Ducarne-Barnardiston document to prove that Belgium had, in 1906, broken its neutrality by a secret treaty with England. After the discovery of this document in the archives of Brussels, the Germans published it in garbled form, substituting for the word "conversation" the word "convention," and omitting the im-

BELGIUM—Continued

portant sentence: "The entry of the English into Belgium did not occur until after the violation of our neutrality by Germany." Later the Germans admitted their error in part, but maintained that two chiefs of the Belgian General Staff—Ducarne in 1906 and Jungbluth in 1911—on behalf of their government, had, with the English General Staff, prepared a joint campaign against Germany.

It is easy to prove that the Ducarne-Barnardiston and Bridges-Jungbluth interviews were of a purely personal nature. The Chief of Staff was responsible for the preparation of the Belgian army for war, and had no other object than to gather information of value in case of eventual attack. He would have proceeded in the same manner with the French or the German attaché.

The measures taken by the Belgian higher command at the mobilization leave no doubt on this point. The Belgian field army consisted of six infantry and one cavalry divisions. Mobilization was ordered for 7 p. m., July 31, 1914. The 1st or Flanders division was assembled to prevent English violation of Belgian neutrality, the 3rd or Liége division watched Germany, and the 4th and 5th divisions observed France, the former against an attack on Namur and the latter against an attack from the direction Maubeuge-Lille. It was the duty of each to prevent any invasion until the other five could be brought to its assistance. Even the German note demanding free passage thru Belgium did not effect any change in these dispositions. Further, at the same time that the government replied to Germany that violation of Belgian neutrality would be resisted, it refused military aid offered by the French ambassador on the grounds that Belgium had not yet called upon the guaranty powers and reserved the decision for itself. When, on the night August 3-4, it became apparent that the Germans intended to invade Belgium, the army was concentrated facing eastward, and on the 4th, when the invasion had begun, Belgium applied to the powers for aid. (Report of the Army Command.)

Further proof of the impartial resolve of the Belgian authorities to resist invasion from any source whatever is found in the studies undertaken under the direction of the Chiefs of Staff in the War College in time of peace. The course, after two years of study, included practical problems known as the "general staff trip" and the "great graduation problem" in which the officers followed the movements of the army in a supposed campaign up to the moment of conflict. As a rule, if the "staff trip" assumed an invasion from Germany, the "great problem" assumed an invasion from France. The following examples are given in the *Echo Belge:* 1912, the "staff trip" assumed French assistance against a German invasion, while the "great problem" assumed the contrary; 1910, the "great problem" dealt with operations against an English army which, having landed between the Sambre and the sea, was attempting a junction with a French army south of the line of the Sambre and Meuse, while the "staff trip" assumed operations in Luxemburg against the Germans; 1909, the "staff trip" assumed English invaders in Flanders, while the "great problem" assumed German invaders north of the Sambre-Meuse line; 1904, the "staff trip" assumed German invaders of Luxemburg while the "great problem" assumed French invaders crossing the Semois.

(To be concluded.)

BILLETING

[Billeting. From Authentic Sources. *Infantry Jour.*, June, '17. 1500 words.]

Whenever camping is impracticable, troops must resort to bivouacking or billeting. Considering the health and comfort of soldiers and animals, billeting is far preferable, and bivouacs are only resorted to when no quarters are available, or when troops must be kept concentrated or in readiness for instant action.

Two classes of quarters are recognized, *ordinary quarters* and *close quarters.*

Ordinary quarters are used when distant from the enemy, when the comfort of the troops is the prime consideration.

Close quarters are used during fatiguing marches, avoiding the sending of troops long distances, and when in close contact with the enemy. Buildings are packed to their limit, the different arms are not mingled, and the units are distributed from front to rear in the order in which they will come into action.

General Rules:

(a) Depots should be near good roads.

(b) Dismounted troops should be nearest the water supply.

(c) Staffs and hospitals have the first claim on quarters.

(d. Mounted troops have precedence when quarters are limited.

(e) Hospitals should be in quiet spots, in most sanitary position.

(f) Staff and telegraph offices, clearly marked, should adjoin if possible.

(g) Officers must be near their men and units quartered together.

(h) A column halted for the night only should not be quartered more than one mile from the next day's line of march.

Allotment of quarters: The chief of staff allots billeting areas to corps and divisions, and their chiefs of staff allot areas to the brigades and smaller units. In making assignments, the rule is that an area can house and feed for one week, a force double the population, and can house without feeding, five to ten men for each inhabitant.

Billeting parties: The regimental billeting party consists of one staff officer, one non-commissioned staff officer, and two privates from each company. The officer presents the requisition to the proper local authority, informing him of the time the troops will arrive, of any special rules the inhabitants must observe, and asking information concerning the water supply, the presence of infectious diseases, etc. If

there is time, the local authorities prepare an order which, presented by the billeting parties, shows the number of men and animals each inhabitant must quarter, and whether or not he must provide food and forage.

The officer distributes these orders to the company representatives in proper proportion, giving necessary instructions as to water supply, special guards, location of headquarters, posting of warnings on infected buildings, and the time and place for assembly after the quarters are inspected.

Each company party proceeds to the allotted quarters, presents the mayor's order to each occupant, inspects the building, and marks on each door with chalk, the names of the officers and the number of enlisted men and animals to be quartered. These marks will be erased before vacating the quarters.

Meanwhile the officer selects and marks the location of headquarters, guard house, headquarters stables, and locality for gun and pack trains. He will ascertain suitable lines of communication with neighboring units, and prepare a sketch showing general areas for each unit, and roads, communications, etc. He will reassemble his party, point out the various locations, and direct them to rejoin their organizations, to act as guides.

When time is not available for the above procedure, the same general plan is carried out. The troops are halted outside of the assigned area; the civil authorities inform the inhabitants what is required of them; and the billeting party roughly assigns certain areas to the larger units who in turn assign certain streets or buildings to their units.

The following points should be observed in allotting quarters:

(a) Pay regard to the interests of the inhabitants as well as the comfort of the men.

(b) Place staff officers where they may be easily found.

(c) Place mounted men near their horses, guns and wagons.

(d) Allot both sides of a street to the same unit.

(e) Roads and communications should never be blocked.

General rules in quarters: (a) Officers must visit the quarters of their men at irregular times, once every day and every night.

(b) If necessary, disarm the inhabitants, keep them indoors except at stated hours, and require them to carry lights at night.

(c) Telephones and telegraph must be seized and steps immediately taken to prevent inhabitants conveying information to the enemy.

(d) Men must take every precaution against any leakage of military information, by guarding their talk and not leaving papers and letters around.

(e) Place all liquor under control. Keep a guard over the arms, which must be kept indoors. Issue directions concerning fire and lights, to guard against fire and signalling to the enemy.

(f) When enemy is within striking distance, fortify the villages in the front line and hold a portion of the troops in them in constant readiness.

(g) Arrange an alarm signal and places of assembly, and exercise troops in quickly turning out and assembling.

(h) In certain cases, such as sieges, it may be necessary to move inhabitants outside of zone of operations.

BOMBS

See also
GRENADES

—Aerial

See also
AERONAUTICS—BOMBS AND BOMB-DROPPING
ILLUMINATION—FOR NIGHT ATTACKS
TORPEDOES—AERIAL

—Aerial—Ballistics of

[Dropping Bombs from Airplanes. By Jean-Abel LeFrance. *Aerial Age Weekly*, Aug 27, '17. 1900 words.. Illustrated.]

Last February a French aviator, Capt. Guynemer, brought down inside the French lines one of a raiding squadron of 20 German bombarding planes of the newest type manufactured by the Gotha Wagonen Fabrik. An interesting feature was the Goerz sighting telescope or range-finder, designed to facilitate the taking of correct aim at objects to be bombarded. Any object dropped from a height is subject to two constant forces, the resistance of the air, and the acceleration due to gravity. If the bomb be dropped from an airship in motion it will have an initial speed equal to and in the same direction as the latter. If the bomb be dropped from an avion which the strength of the wind causes to be stationary with respect to the ground, the curve of its trajectory will be a function solely of the drift produced by the wind; it will therefore fall to the rear of the point of departure. Since these trajectories are curves, the height of the avion above the object aimed at is an element which modifies the value of the trajectory. Take an avion having a normal speed of 150 km. per hour. It is only necessary to know the speed of the bomb and the height of the avion to determine the trajectory.

Goerz Range-Finder.—This is certainly the best and most highly perfected effort of German science to find means of destroying railroads, factories, etc., outside of the range of the big guns. It consists of a telescope about one meter long, mounted on a universal joint. It can be oriented in every direction and be kept strictly vertical whatever be the position of the avion. At the base of this telescope is a prism mounted on a pivot and controlled by a graduated disk. On this disk are two indexes, one corresponding to the vertical speed, or dead point of the range-finder and the other to the vision of 22° 30'. In the body of the telescope is a spirit level. The edges of the air bubble are refracted in such manner that they appear in the form of a black circle which serves as a sighting center for the telescope.

BOMBS—Continued

The height is obtained by subtracting from the altitude range shown on the altimeter of the avion the altitude of the object bombarded. The initial velocity of the bomb is the most difficult to know, because it varies with the wind.

To determine the kilometric speed of the avion we calculate the time required by a fixed point on the ground *O* to traverse an angle fixed at 45° or 22° 30′. It is easy to see by a figure that the time required by an avion to find the range of the same point successively first with an agle of 22° 30′ and then vertically is proportional to the speed of the avion with respect to the earth. A previously prepared table will indicate the initial horizontal speed of the bomb. Thruout the whole bombardment the pilot must keep his craft strictly head on to the wind, the air bubble must be kept rigorously in the center of the ocular, the play of the prism alone serving to seek the object. It eliminates errors except from new and practically incalculable elements, such as variations of forces and directions of the wind between the altitude at which the sighting is done and the ground, or when it becomes impossible to keep the avion head on toward the wind.

[The Elements of Bomb-Dropping. *Air Service Jour.*, Nov, '17. 2000 words. Diagrams.]

It is evident that we are dealing fundamentally with the behavior of a falling body under the force of gravity; in addition the airplane is traveling at some speed relative to the ground. Further conditions arise from the frictional resistance of the air and the influence of wind and air currents.

Except in the case of an airplane remaining stationary over its objective or flying in an opposing wind of equal velocity, the attacking airplane will be approaching the target with a velocity relative to the surface of the ground. At the instant when released from the machine the bomb will possess a velocity relative to the ground in a horizontal direction. If we assume the absence of any material atmosphere the trajectory of the bomb will be a parabola.

This curve is only the theoretical case of the path followed by the projectile in its fall. It is however of fundamental importance because the trajectories obtained in practice are only modifications of this fundamental one. Apart from the effects of air-resistance and wind, the shape of the trajectory is determined simply by the altitude at which the airplane is flying and by its horizontal speed relative to the ground. It seems that the trajectory is little altered by air friction altho the time taken to fall to earth is increased. This would lead one to expect that the projectile would strike the ground ahead of the point where the parabola intersects the ground line. On the other hand, the resistance of the air exerts a retarding effect in the forward motion of the bomb so that, while leaving the airplane with the horizontal speed of the plane, it will reach the earth with a reduced horizontal velocity. This latter probably more then counterbalances the increased time of fall so that the bomb will describe a path very similar to the parabola. A further modification will arise according to the force and direction of such wind as may be blowing.

If the attacking aircraft is flying towards its objective either with or against the wind, then the drift of the air will help or hinder the travel of the bomb in a forward direction. The resistance of the air to the horizontal component of the motion of the bomb is that due to the static frictional resistance of the air with an added force caused by the wind. In a gale this force may be great enough to overcome the forward momentum of the bomb, and even set up a backward motion. Quite the opposite effect is produced by a wind blowing in the direction of flight.

The effect of vertical air currents can probably be ignored. The last condition is that which arises in cases where the airplane is either climbing or diving. If the machine is nose diving the bomb is already possessed with a downward velocity which reduces the time of fall; conversely, this time is lengthened if the machine is climbing.

The conclusion which obviously follows from the tendencies traced out is that the attacking aviator must release his bombs some time before the objective is passed over in the course of the flight. The actual point at which the release must occur is determined by a combination of all the conditions already considered, and these may be summarized as follows: altitude, speed relative to the earth, wind in force and direction, up or down motion of airplane.

—Aerial—Incendiary

[Examination of the Construction and Contents of an Enemy's Incendiary Aircraft Bomb; Measures and Precautions in Case of an Incendiary Bombs Attack. By Dr. A. Wellenstein, Director of the Food Research Institute of the City of Trier. From *Chemiker Zeitung,* No. 1-2, '16. *Svensk Kustartilleritidskrift,* Part 1, '16. 1450 words.]

Some time ago the city of Trier was attacked by hostile aircraft which dropped some bombs over the city. One of these which had not exploded was examined in order to ascertain what it was loaded with and also if it were necessary to take special measures and precautions in case of fires caused by such bombs.

This bomb had the form and appearance of a 7.5 c. m. shrapnel. To the point was attached a metallic capsule in which the explosive cap was located and connected with this was a tube of soft metal containing 20 gr. of picric acid. The rest of the interior of the bomb was entirely filled with pieces of a solid body immersed in a fluid.

It was ascertained by analysis that the solid pieces consisted of yellow phosphorus and the fluid *probably* molasses whose function was simply to keep the air from acting on the phosphorus while in the bomb.

It was ascertainable by experiment that burning phosphorus immediately melts and if it is on a sloping surface spreads out as burning fluid. Therefore, if such an incendiary bomb explodes inside a building the burning pieces of phosphorus will be hurled against the walls and other objects and melting and running down

these will have a very incendiary effect. In addition to this a great deal of smoke is given out.

The best means of extinguishing such a fire is by applying moist sand. A stream of water is apt only to scatter the particles of burning phosphorus and so when sand is not available a rose sprinkler should be used. The unburnt pieces of phosphorus should be removed from the building and *buried* as soon as possible, since they ignite spontaneously when exposed to the air. It is known that phosphorus if taken into the stomach is very poisonous, only a few centigrams being needed to cause death. There is not, however, much danger of its being taken internally in this case, except in the form of poisonous gas, but there is great danger of receiving dangerous burns from it either by carelessly taking hold, with bare hands, of the pieces of phosphorus even when these are not ignited, or having them thrown on one and thus igniting the clothing.

Hager shows that burns caused by phosphorus are very painful and may become dangerous thru absorption of phosphorus. He recommends as an antidote a solution of 0.3 gram. nitrate of silver in 4 gram. distilled water to which are added a few drops of spirits of turpentine, and this solution should be painted into the fresh wound.

Owing to the fact that burning phosphorus not only rapidly uses up the oxygen in a room, but also generates poisonous gases, it is recommended that persons who happen to be in a room where such a bomb explodes immediately vacate it and that no one re-enter unless provided with the proper gas masks or helmets.

[Protective Measures Against the Effect of Incendiary Bombs. Anonymous. *Schweiz. Zeit. f. Art. u. Genie*, Apr, '16. 350 words.]

(A transcript from *Militär Wochenblatt*. An examination of a French incendiary bomb which had failed to explode showed that it was filled mostly with yellow phosphorus, the bursting charge being only sufficient to project this incendiary matter in all directions. Instructions are given in the article of handling or extinguishing burning phosphorus.)

—Launching of

[Bomb Throwing from Aircraft. *Aerial Age Weekly*, Oct 9, '16. 1560 words. Illustration.]

Considerable damage has been done by bombs dropped from aircraft in spite of the fact, that it is more difficult to hit a target while moving thru the air than it is to hit from a stationary battery on the ground. The trajectory of a bomb dropped from a moving air-ship is the result of two forces, (1) gravity, (2) the forward movement of the ship. A figure in the illustration shows that a bomb dropped on a target hits the target at the same time that the air-ship passes a point vertically above the target. If an air-ship is moving at a velocity of 40 m. per sec., at a height of 1000 m., the bomb dropped will take about 14 sec. to reach the ground ($s=\frac{1}{2}at^2$). Therefore the bomb must be dropped when the ship is $d=40 \times 14 = 560$ m. in front of the target. The distance in front of a target at which a bomb must be dropped varies with the height of the ship and its velocity. A bomb dropped a half second too soon or late will fall 20 meters from the target; for this reason, a dirigible is superior to any aeroplane for bomb dropping, for it can reduce its speed as desired and may even stand still over a target and drop bombs. One force not considered above is the air resistance. This may be constant as in still air or variable as when there is a wind.

In the first case it can easily be determined by experiment; but in the second, it is very hard to allow for it. Wind may vary in both direction and velocity at different altitudes. The altitude of an air-ship is determined by the use of a barometer or barograph, with fairly accurate results. However, it is necessary to know the altitude of the target above sea level in order accurately to determine the height of the ship above the target. This is usually obtained from a map. The velocity of the ship is obtained by taking the time necessary to pass over the distance between two objects, and then measuring the distance from the map. If the distance between points on the ground is not known, the velocity of a ship may be determined by measuring the angle to a prominent object, and then taking the time necessary to pass directly over it. The barograph gives the altitude, and one angle having been measured, it is necessary only to solve the right triangle for the one side over which the machine passed. Then the velocity is determined, having the distance and the time necessary to traverse it. Any object may be used simply by taking two observations and solving two triangles. Of course this must be done before the place for dropping the bomb is reached. (An arrangement for making the necessary observations is described and illustrated.)

BORGARD, Gen. Albert

[An Account of the Battles, Sieges, etc., wherein Lieut.-General Albert Borgard hath Served. Communicated by General Sir J. H. Lefroy, C.B, K.C.M.G., R.A. *Jour. Royal Artillery*, May and June, '16. 5000 words.]

An account of the services of Lieut-Gen. Albert Borgard, first Colonel of the Royal Artillery, covering a period extending from 1665, when he served as a cadet in the army of his native country of Denmark, to 1722, the date of the final renewal of his commission as Colonel of the Royal Regiment of Artillery. From a ms. in the Royal Artillery Institution Library, Woolwich. (Historical only.)

[Remarks on the Services of Lieut.-General Albert Borgard. By Lt.-Col. H. W. L. Hime, R.A. *Jour. Royal Artillery*, May and June, '16. 9000 words. 2 appendices.]

An analysis of the record of services of General Borgard, pointing out errors and inconsistencies in the record as preserved in the Royal Artillery Institution Library. One appendix gives a list of works relating to the Polish wars of the seventeenth century, and the other a list of documents by General Borgard in the Royal Artillery Library at Woolwich. (Historical only.)

BRAZIL
—History
See also
PARAGUAYAN WAR
SOUTH AMERICAN WARS FOR INDEPENDENCE

BRIDGES, Military
See also
CAVALRY—SPECIAL DUTIES
RIVER CROSSINGS

[Rapid Calculation of Dimensions of Wooden Members in Improvised Bridges. By Alberto Pozzo. *Rivista di Artiglieria e Genio,* Oct-Nov-Dec, '16. 4000 words.]

(This is a mathematical discussion, consisting chiefly of equations and having as its object the deduction of expressions for the diameter of round timbers and the breadth and depth of squared timbers in improvised bridges when the span and the load are known. The discussion covers loads varying from infantry in column of twos to auto trucks weighing 13,000 lbs.)

[Military Engineering of the Teutons. *Scientific American,* May 5, '17. 2500 words.]

German engineers in the advance thru Serbia developed the "knock down," "comepackt" bridge, one of the cleverest engineering feats brought out by the war. The bridge parts all come stamped out and punched and remind one much of the toy sets with which a boy can build anything from a sky-scraper to a merry-go-round. The bridge members are reduced to four standard parts which can be assembled to erect a span of from 10 to 100 feet, namely, a diagonal section, chord section, floor beams, and an I-beam section. Bolts, nuts and washers bind the whole together.

The parts are made of pressed steel, stamped out and punched in the factory. The only tools needed for the erection are wooden mauls and wrenches.

—Design

[The Design of Timber Columns for Use in the Field. By Capt. J. W. Landon. *Royal Engineers Jour.,* Sept, '17. 2500 words. Illustrated.]

(A brief, practical presentation of the determination of safe working loads for solid and built-up wooden columns, based upon Gordon's formula. This formula gives loads considerably less than those used by some authorities, but for field purposes this is probably desirable. Several problems setting forth the underlying principles of strut design are solved in full. Figures of two built-up trestles are given and their strengths computed.)

BROWNING MACHINE GUN
See
MACHINE GUNS—UNITED STATES

BRUNTON, Sir Thomas Lauder

[Sir Thomas Lauder Brunton, M.D. (1844-1916). An Apostle of Preparedness. By First Lt. F. H. Garrison, O.R.C., U. S. A. Portrait. *The Military Surgeon,* Apr, '17. 2100 words.]

(A sympathetic memoir, bringing out especially its subject's interest in preparedness. Brunton was early compelled to drop the subject of military preparedness and concentrate upon physical preparedness. His efforts, like Lord Roberts', came to naught, and Great Britain is to-day paying the price of her indifference.)

BUDGETS
See
FINANCES, MILITARY

BULGARIA
—Army
See also
EUROPEAN WAR—FORCES ENGAGED—CENTRAL POWERS
—History
See also
EUROPEAN WAR

[Bulgaria: A Retrospect. By T. Miller Maguire, M.A., LL.D., F. R. Hist. S. *United Service Magazine,* Dec, '16. 2800 words.]

(Recent historical sketch.)

BULLET-PROOF CLOTHING
See
ARMOR—PERSONAL
HELMETS—ARMORED

BULLETS
See also
SHRAPNEL—BULLETS
—Incendiary

[Incendiary Bullets for Aircraft. *Scientific American,* Feb 10, '17. 125 words.]

British aircraft for the defense of England are armed with an efficient incendiary bullet, the use of which set on fire the Zeppelin brought down a few months ago on the outskirts of London. The bullet carries a charge of highly inflammable and smoke producing material, ignited on discharge, which ignites the gas contained in a Zeppelin.

CAMPS
See
ENCAMPMENTS

CANADA
—Army
See
PENSIONS, MILITARY—CANADA
—Expeditionary Force for European War
See also
TRAINING CAMPS—CANADA

[Note. *Army & Navy Jour.,* Jan 6, '17. 50 words.]

Canadian recruits in 1916 numbered 178,537, nearly half of all since the outbreak of war. In the last fortnight 2517 enrolled, 700 fewer than the preceding two weeks.

[Canada's Half Million. *Independent,* Feb 26, '17. 700 words.]

Canada has raised 434,539 men for service overseas, 120,000 more than Great Britain asked for. Canada has pledged herself to supply 500,000 men, or one-sixteenth of her total population. 175,000 Canadians have seen active service, and 70,000 have appeared on casualty lists.

[The Canadian Command. *Army and Navy Gazette,* June 30, '17. 500 words.]

Sir A. W. Currie, a Canadian who has proved his quality in the best of schools—experience—has succeeded Sir Julian Byng in command of the Canadian forces in France. With the increasing demands upon the services of those who are left of the Old Army, a Canadian was sooner or later bound to command the Canadian forces in the field.

[Enlistments Exceed Casualties. *Canadian Military Gazette,* Aug 14, '17. 300 words.]

June and July showed 10,698 enlistments as against 7894 casualties, according to statement of the Minister of Militia in (the Canadian) Parliament. He also gave the following as the disposition of the 329,943 men of the Canadian Expeditionary Force sent overseas to June 30. There were in France 142,779; in England, 124,399, of whom 23,265 were in hospitals or convalescent camps; killed, died of wounds, missing or prisoners, 31,955; en route to Canada, 3944; discharged or returned for discharge, 26,000. There were in Canada June 30, 18,475 men belonging to units of the C. E. F. 76,038 were discharged or otherwise left the service without being sent overseas.

—History

[The Importance of Canada. A Controversy of 1760-3. By Katherine F. Doughty. *United Service Magazine,* Jan, '17. 4400 words.]

(Historical.)

—Military Policy of—Compulsory Military Service

[Conscription. *Canadian Military Gazette,* Aug 28, '17. 600 words.]

The Military Service Act calls out for active service by classes a total number not to exceed 100,000 until further authorized by Parliament. Population of Canada is about 8,000,000.

The first class to be called out will consist of unmarried men, or widowers without children, between 20 and 34 years of age. Deducting for women and children, for persons of foreign birth not naturalized, for those physically unfit, and for the men serving at the front, and allowing for the increase in population since the census of 1911, it is estimated that there are over 500,000 single men fit for military service under class I, so that only one in five of those available need be taken.

Tribunals are established for judging appeals. The exemption clauses are broad and cover men having special qualifications for other employments, and training for special work, having exceptional financial or business obligations, special domestic ties, conscientious objections, and those in ill health. These exemptions may be from combatant service only, or limited in other ways. Men called out may be transferred to the naval service.

Penalties are provided for false representations, evasions, etc. There are many other provisions, but the above covers the main military features. The act is to go into effect immediately.

—Munitions—European War Orders for

See

EUROPEAN WAR—MUNITIONS AND MUNITION MATERIALS—ORDERS FOR IN CANADA

CANALS

See also

PANAMA CANAL

CAPRONI TRIPLANE

[Italy's Huge Bombing Triplane. *Popular Science,* Nov, '17. 500 words.]

Italy has brought forth a new machine of the Caproni type. It climbs 3250 feet in thirteen minutes, 6500 in twenty-seven minutes, 10,000 feet in sixty-seven minutes. It carries three men, three shell guns, 7500 pounds of bombs and fuel for six hours. Its 900-horsepower engines drive it at a maximum speed of eighty miles an hour.

It is regarded by the Italians as the superior of the long range cannon as it can, of course, drop explosives far beyond the range of the heaviest artillery.

In order that the immense structure might be solid as a whole and yet not too heavy, power is generated by three engines distributed over a full third of the wing span thereby lowering the leverage of the weight on the truss. The engines are each inclosed in a streamline body in order to decrease the resistance. The middle body is the shortest; hence its three bladed propeller is mounted in the rear. The two outer bodies have two-bladed tractor propellers.

CARRIZAL, Action at

[The Cavalry Fight at Carrizal. By Capt. L. S. Morey, 10th Cavalry. *Jour. U. S. Cav. Assn.,* Jan, '17. 1800 words. One sketch map.]

(EDITORIAL NOTE.—The description of this action from was received from the camp commander (whose unselfish action in causing three troopers to abandon him, wounded and exhausted, and save themselves, is already known thru the public press.) One is impressed by the fact that there were but 56 troopers in the firing line when it began its advance. Aided by machine gun fire, it was easy for the Mexicans to envelop the flanks.)

Shortly after midnight of June 17-18, 1916, an order was received by the camp commander (whose command comprised two troops of cavalry, location of camp not definitely stated) directing him to send a troop of cavalry to make a reconnaissance in the direction of and beyond Carrizal. He was informed that it was reported that Gen. Trevino would regard such a movement as unfriendly. Troop K was selected for the reconnaissance. On account of the difficulties of the country—lack of water, poor grazing, and insufficient transportation—the march promised interesting

CARRIZAL, Action at—Continued

lessons. The troop numbered one officer and 46 men. The first day's march was 21 miles, and the second 30. The third day the single wagon and the led horses were sent back with 10 men, leaving only 36 men. Twenty-six pounds of grain, six pounds of rations and 150 rounds of ammunition per man were carried.

On the third day, Troop C, 10th Cavalry, was met. It was under Capt. Boyd and its mission was similar to that of Troop K. Capt. Boyd assumed command and the two troops joined forces. It was learned that Carranza's cavalry, 400 strong, was at Carrizal.

Capt. Boyd decided to march at 4:00 a. m., June 21. Arriving at 6:30 a. m. at an irrigation ditch southwest of Carrizal, a messenger was sent in to ask permission to march thru. A few men—evidently the outpost—were seen forming in the trees west of the town. An irrigation ditch, deep but passable in places, ran along the western edge of the town. A conference with the Mexican commander, Gen. Gomez, was held, lasting about an hour. During this conference, Mexicans were moving into position in the irrigation ditch, and twice the American troops were moved nearer to the town. Capt. Boyd's final instructions were for Troop C to move forward with Troop K guarding the right flank. Both troops dismounted, and moved forward in a skirmish line. The Mexicans opened with a machine gun and the whole line joined in the fire. Our troops returned the fire. Capt. Boyd's troop (about 30 rifles) advanced across 200 yards and drove back the machine gun and Mexican troops in his front. Capt. Boyd was killed soon after the first fire. Lieut. Adair was wounded early in the fight and again mortally after he reached the irrigation ditch. Troop K advanced with an interval of 200 yards between it and Troop C. Thus the two troops were able to give little fire assistance to each other.

Troop K was received with a hot fire. Captain Morey was wounded. The Mexicans were working around the right flank and the troop was ordered to fall back. Both troops retired in a scattered line toward the northwest and reached the ditch from which they had started. Here most of them were later captured, as were also others who had retired further up the ridge. Troop C lost both its officers, four men killed, four wounded, and eight prisoners. Troop K lost four men killed or missing, one officer and six men wounded, and fifteen prisoners. The led horses had been driven off during the fight. The men remained cool and stood fire well under trying circumstances.

Troop M came out on the route followed by Troop K and picked up several men, most of them horse-holders. Col. Jenkins, in command of the 11th Cavalry, picked up men of both troops on the line followed by Troop C in going out.

The Mexicans lost 12 officers and 33 men killed and 53 wounded.

One officer and ten men lost their lives in the service of their country following a brave officer who went to his death leading men forward into what looked like certain death.

CARS

See
RAILROADS—CARS

—Armored

See
AUTOMOBILES—ARMORED

CASUALTIES

See
WAR—LOSSES IN

CATAPULT

[Trench Catapults. *Rivista di Artiglieria e Genio,* Jan, Feb, Mar, '17. 80 words.]

One method adopted by the Germans for throwing bombs from one trench to another nearby trench is by means of a catapult very similar to that used in ancient times. The Grell catapult throws bombs a distance of about 95 yards and the Simon catapult throws them about 310 yards. The force for throwing the bombs is derived from strong rubber cords.

CAVALRY

See also
EQUITATION
HORSES
MARCHES AND MARCHING—SPEED AND DISTANCE—CAVALRY
RECONNAISSANCE

[Something About the Cavalry Arm. By General José de Albuquerque. *Memorial de Caballeria,* July, '16. 2100 words.]

(Comments are made on the tactics, instruction, organization, and equipment of the cavalry of today. The extraordinary demands now made upon this arm require that it receive appropriate organization and the most exhaustive instruction; also that the officers should be highly intelligent, well educated in their professional duties, and enthusiastic cavalrymen.

[Letters of Gen. Ochando. *Memorial de Caballeria,* Feb, '17. 1000 words.]

Lt.-Gen. Ochando in a letter to the Editor outlines his conception of the rôle of cavalry of to-day, and makes certain recommendations referring to the training and use of this arm.

Italy

[The Light Cavalry of Italy. *Jour. U. S. Cav. Assn.,* Jan, '17, 800 words.]

The Italian light cavalry regiment resembles our own (U. S.) cavalry. It is armed with the carbine and saber, and everybody wears a steel helmet. The horses are good, but under present conditions it is impossible to adhere to one color in the regiment. The drill is excellent. A squadron (146 troopers) is increased

to 250 when designated for dismounted duty, and the horses are turned over to territorial troops for care. After such a break in training, neither horses nor troops are in the best condition. Extensive use is made of dismounted action. There is considerable jumping in mounted work, and proper co-ordination is had in mounted and dismounted work.

The machine gun detachment of a regiment has four Fiat-Revelli (modified Maxim) guns, carried on pack horses.

There is a total of 60 bicyclists (12 to each squadron) in a regiment, which is an improvement over our "mounted orderly" scheme.

The Italian cavalry officers are better mounted than our officers, taken as a class. All officers take all obstacles in cross-country maneuver work, a procedure toward which our Mounted Service School is tending.

United States

[Extracts from a Regimental Scrap Book. By Sev. H. Middagh. *Jour. U. S. Cavalry Assn.*, Apr, '17. 9500 words.]

(An account of the service of Fighting Fifth, organized at Jefferson Barracks as the Second Cavalry by authorization approved Mar 3, 1855. Such names as Lee, Hardee, Johnston, and Thomas, are associated with its organization. The regiment marched from Jefferson Barracks Oct 27, 1855, and reached Fort Belknap Dec 27. Follows an account more or less in detail of the operations of the regiment until it arrived at Carlisle Barracks, Apr 27, 1861.)

[Will Organize Cavalry Divisions. *Army & Navy Jour.*, Nov 24, '17. 500 words.]

Twenty-seven regiments of cavalry are to be included in the immediate plans for the division reorganization in that arm of the service which are now being discussed by the War College.

The French and British high commands are said to have at their disposal cavalry units adequate for present contingencies. Therefore it would seem that the most logical station for these regiments is the Southern border.

—Arms

[New Armament of Cavalry. *Memorial de Caballería*, Dec, '16. 3400 words.]

In an order of the Ministry of War, dated 14 Nov., 1916, the Mauser carbine, model of 1895, was replaced by the *Mosquetón*, model 1916, with the machete bayonet, model 1913. This order constitutes a great victory for the Fourth Section (Cavalry) of the Central School of Fire. Its provisions are in line with the procedure of all modern armies in providing the cavalry with a firearm of power equal to that of the infantry. The bayonet is the same as the last model issued to the infantry. It is to be carried habitually on the person in order to have it available when fighting on foot. The only armament now needed to completely equip the cavalry is the light machine gun soon to be supplied.

—Arms—Pistol

[The Automatic Pistol in the Punitive Expedition. By Lawrence J. Fleming, Lieut.-Col., 5th Cavalry. *Jour. U. S. Cavalry Assn.*, Apr, '17. 7000 words.]

The cavalry has been armed with the automatic pistol for over two years, but little has been done to develop its use. Experience in Mexico led to the appointment of a board to conduct experiments to determine the best methods of using the pistol in action and of training men for that use.

A questionnaire was sent out by the board and an order issued by General Pershing enjoining upon officers study of the subject with a view of submitting their views to the board.

Replies to the questions indicated a majority opinion in favor of the automatic pistol as an arm for the cavalry, using the present number of clips in leather pockets; the use of a gallery automatic for training purposes; compulsory firing once a month; and the use of the pistol in dismounted action against trenches The answers to most of the other questions were not susceptible of classification. As a result of the experimental work three distinct results were arrived at:

1. A manual of the pistol.
2. A course of pistol practice.
3. A demonstration of both to assembled officers and non-commissioned officers.

All the cavalry of the expedition are now (were) engaged in practising the manual and firing course laid down, and opinion was that they were practical and of a kind to lead to use in action.

Some of the conclusions of the board were: (6) that better results are attained by training horses to mounted fire first collectively and then individually; (7) that the dangers and difficulties of charging in line or column with the automatic pistol have been greatly exaggerated; (8) that the pistol charge can be delivered from various formations; (12) that in firing automatic fire the arm must be straight but without locking the elbow; (13) that in dry weather the automatic pistol can be kept in working order by wiping dry after cleaning and blowing or brushing off the dust, and in wet weather by keeping well oiled. (Various other conclusions are given. Various recommendations follow concerning improvements in the pistol and other items of equipment.—Ed.)

COMMENTS. (By J. J. P.)

The assembly of five regiments of cavalry in the field afforded an opportunity to try out questions concerning the automatic pistol. Unless cavalry can be trained to use the pistol with confidence in mounted work, the retention of such a weapon would be questionable. The men must be trained to handle the pistol without danger to themselves or to others, and the horses must be accustomed to firing. The latter can be quickly accomplished. Untrained remounts were taken in hand by trained troopers and used in the charge, troopers firing to the front at suspended targets, after 30 minutes training as a group. The proposed system, if adopted, will revolutionize pistol

CALVARY—Continued

practice and add materially to the efficiency of the cavalry by increasing the importance of mounted action.

(The proposed manual for the automatic pistol, caliber .45, is then given in full, as well as a full description of the demonstration of the use of the pistol. The latter included preliminary instruction dismounted in the manual of the pistol, firing with ball cartridges, and in exercises to strengthen the muscles of the fingers, wrists, and forearm; drill mounted in the manual of the pistol, mounted firing to accustom horses to this work, and practice in loading and firing mounted; range practice dismounted in slow fire, quick fire, automatic fire, and trench fire, all at suitable targets with a score of seven shots; range practice mounted charging to the front; and a time test in loading and firing the pistol at the gallop. In the latter test magazine had to be changed twice and three shots fired in 34 seconds, speed at least 12 mi. per hour.)

Demonstrations of four additional exercises were ordered as follows: (1) firing as foragers; (2) in column of twos firing to the right and left; (3) charging by sections to represent the mounted charge against cavalry; and (4) charging by platoon, close order, at suspended targets, using horses that had not been used in the practice at any time. The last exercise was to show that previous training of the horses was unnecessary.

—Arms—Saber

[The Present Saber—Its Form and the Use for which It Was Designed. By 1st Lt. G. S. Patton, Jr., 10th Cav. *Jour. U. S. Cavalry Assn.*, Apr, '17. 1800 words.]

(Calling attention to the fact that the methods of attack described in the *Saber Manual*, 1914, are also methods of defense. The author contends for the use of the points instead of the cuts, as in the charge the point gets there first. The *Saber Manual* is an almost verbatim copy of the new French Manual, and France is the foremost nation of the world with the saber. All Europe except Russia follows her in the use of the point.

The present manual should only be changed when the lessons of the present war can be incorporated in the revision.)

—Drill Regulations

United States

[Cavalry Drill Regulations, 1916. By Col. W. D. Beach (D. O. L.), Cavalry. *Jour. U. S. Cav. Assn.*, Jan, '17. 4000 words.]

(This article reviews the work and gives the final conclusions of the board appointed to revise the Cavalry Drill and Service Regulations.)

The board considered certain reports submitted by cavalry officers, in which there was very great unanimity of opinion concerning the following points:

(a) The return to the single rank as the normal mounted formation.

(b) The retention of the *leading* principle.

(c) The column of fours instead of the column of platoons as the habitual march and maneuver formation.

(d) In respect to weapons that greater relative prominence be given the rifle and pistol as compared with the saber.

(e) Greater attention to details in description of ceremonies.

(f) The statutory cavalry organization in preference to the provisional one.

(The regulations as adopted and published are then discussed in certain particulars.)

—Equipment

United States

[Notes on Cavalry Equipment. *Jour. U. S. Cav. Assn.*, Jan, '17. 2000 words.]

The model 1912 hinged-model saddles show numerous cases of cracking of the steel frames. A wire cutter carrier (Infantry Equipment Model 1910) is recommended for issue to be attached to the belt. The wire cutter will be transferred from the saddle bag to the carrier when ordered. Most of the reports on the halter bridle have been adverse, but recently two very favorable reports have been received. [These are quoted.—Ed.] Halter chains have been under test. A strength of 1500 lbs. is desired. There is difficulty in securing a suitable snap hook of sufficient strength, and an additional toggle may be used.

A carrying device for the automatic pistol has been shown to the Cavalry Equipment Board. The device admits of quick use of the pistol from the belt.

Web saddle pockets are adversely criticised. Our cavalry should carry the rifle on the trooper's back, as all other nations do. The heavy and large saddle blanket is criticised as causing sore backs. Padded side bars are recommended.

[Notes on Cavalry Equipment. By Col. C. D. Rhodes, Cavalry. *Jour. U. S. Cav. Assn.*, July, '17. 4000 words.]

The Cavalry Equipment Board, originally composed of five members and finally reduced to two, is nearing the completion of its labors.

The board adopted the French officer's saddle slightly modified for the use of officers, and the "Richmond No. 2" for a polo saddle. These will probably be on sale to officers shortly.

All reports on the 1912 equipment were studied by the board, with the idea of making as few changes as possible consistent with efficiency. At the same time, the board had full authority to make such changes as it determined to be necessary to provide adequate equipment within the shortest reasonable time.

Reports condemned the 1912 saddle as not comfortable to rider or horse, and subject to breakage of the steel frame. The method of carrying the rifle was unsatisfactory, and the webbing ration pockets were not rain and sweat proof. The halter bridle was criticized as having "too many straps and buckles." Other minor points in the 1912 equipment were criticized.

The most important item is the enlisted man's saddle. It must be strong enough to carry the equipment under severe conditions, comfortable to the trooper, give a secure seat, permit use of the aids, durable, and of reasonable cost. Many models were made and tried out. One essential is higher and wider pommel and cantle arches than obtain abroad. The board finally recommended a saddle with the seat approximating the officers' saddle, apparently satisfactory as to tree, arches, and side-bars, and provided with skirts.

The 1912 pommel pockets and contents were retained, as were also the minor articles, currycomb, brush, wire-cutters, etc. A new mess kit was devised, but the old one had been found satisfactory for many years and was retained. Leather ration pockets were designed to replace the webbing ones, which were not waterproof. Criticism concerning the saddle skirts of the new saddle led to the remark that the difficulty was due to improper position of the rider.

The saber has been retained with a simplified carrier The question of abandoning the saber should not be decided until the close of the present war.

The packing of the latest experimental saddle follows that of the 1912 model, and there is a gratifying absence of rattle.

The question of stirrups is an open one, with opinion about equally divided between the hooded wooden stirrup and the open steel one.

After much experiment the board decided that the rifle should be carried on the trooper's back. It is found that this is not attended by undue fatigue. The combination halter bridle having proven unsatisfactory, the board went back to the 1909 model double bridle with certain improvements. A rope halter with tie-rope is under consideration and will be tested. The tie-rope will be replaced by a light chain in the field. The length of the pistol holster has been reduced.

The cost of the cavalry equipment is heavy, due to the high and increasing cost of leather. Every effort must be made to conserve the equipment. Officers must study the methods of preserving leather, and enforce care by constant inspections.

Such articles as have been retained from the 1912 equipment have already stood the test of field service. The changes in view are tentative in character, and further tests will be necessary. Two saddles and sets of equipment have recently been ridden 220 miles in three marches of 33.3 miles, one of 58, and one of 62 miles with comfort to the troopers. The horses were in excellent condition at the end of the test. This test is not conclusive, but it warrants further try-out by a body of troops under service conditions.

[War Equipment of the French and British Cavalry. *Jour. U. S. Cav. Assn.*, July, '17. 5000 words. Two tables.]

A new and important bulletin issued by the Chief of Cavalry of the French Army, bearing date of Oct 9, 1916, pertains to the clothing, equipment, camp equipage, armament, and pack of the French cavalry. It has been translated by Capt. J. C. Montgomery, secretary of the Mounted Service School. The bulletin is in large part in tabular form, so the more important items are epitomized instead of publishing the entire bulletin.

Definite regulations are formulated relative to orderlies, of interest because lacking in our service. Two identification tags are required, one worn around the neck and the other on the left wrist.

The significant changes in uniform, equipment, etc., are: the largely increased number of cartridges carried by the individual trooper either on his person or on his mount; the equipping of each trooper with a steel helmet, a gas mask, and two identification tags; the increased importance attached to carrying intrenching tools and reserve rations, so that the trooper may be independent of the trains for periods of time; and increased attention to the carrying of explosives and detonators by individual troopers. No change has been made in the arms.

The British arms and equipment are described in considerable detail. The trooper carries the short Lee-Enfield and a total of 190 rounds of ammunition. In the early part of the war, horseshoes lasted an average of two weeks, indicating the necessity of an adequate supply.

The items of equipment are enumerated and weights given. The total is 38 lbs. carried on the soldier and 97 lbs. on the horse. Averaging the weight of the trooper at 147 lbs., the total load carried by the horse is 282 lbs.

It is noted that the British cavalry feed from three to seven times per day.

—Fire—Instruction and Training

[Comments Upon Fire Instruction for Cavalry. By D. García. *Memorial de Caballería*, Nov, '16. 2300 words.]

It is undeniable that cavalry in combat preferably must use fire power. As fire power is used collectively, it follows that fire units must be organized, and those who are to direct them educated as to their proper functions. The instruction at the *Central School of Fire* includes that of the soldier and that of the officer. The instruction given soldiers is individual. It aims at such training as will enable the men to deliver fire in combat as they have been taught to do it on the target range, without preoccupying themselves with variations or effects, and exercising mechanically and passively their functions as riflemen. The education of the fire unit commander is more extensive and complex. It necessitates a technical preparation that will guarantee the utilization in war of the doctrines acquired during peace.

Instruction of the Soldier

Correct methods of sighting, holding and squeezing the trigger are first taught. Next comes loading (with, for illiterates, a simple system for learning numbers), the positions, classes of fire, rates of the same, estimation of distances, and lessons on the fundamentals of firing. Gymnastic exercises with and without arms are given a prominent place in the course.

CAVALRY—Continued

The fire of small groups is then taken up. This is called "instruction collective fire."

The course ends with lessons in firing mounted.

The plan of the course is methodical and progressive.

Fire instruction is combined with instruction in tactics, with special attention to utilization of the terrain.

Instruction of the Officer

Included in the instruction are the writing of theses upon subjects relating to fire action; the estimation of distances, slopes, and reliefs; the solution of map problems, and of problems upon the ground both with and without troops; practical exercises involving the use of direct and indirect fire, and the technique of fire against aircraft.

[Fire Instruction in Our Cavalry During 1915. *Memorial de Caballería,* Jan, '17. 2900 words.]

A royal order, giving distinguished mention to certain cavalry regiments and squadrons for proficiency in various firing problems, is quoted. The success attained is attributed largely to the influence of the *4th Section of the Central School of Fire.* The data collected were compiled, printed and distributed thruout the cavalry.

—Fire—Target Practice

[Interesting Firing Exercises with Carbines and Machine Guns against Aerial Objectives. *Memorial de Caballería,* June, '17. 5200 words. 5 photographs.]

This is an account of the exercises conducted by the Fourth Section (cavalry) of the Central School of Fire, at Villaviciosa and Brunete during the period Apr 28 to May 12.

The plan of the exercises involved the working out of the following problems:

(a) Progressive and rational instruction of the personnel of troops in firing with carbines and machine guns at elevated objectives and with large angles of site.

(b) Functioning of telemetric service by day and by night at above objective.

(c) Comparison of rules for firing at elevated objectives (presented by the School of Fire).

(d) Fire against aerial targets in motion (at the greatest velocity obtainable) by day and by night.

(e) Functioning of anchored and free balloons.

(f) Use of searchlights; technical proceedings for this service; holding light and telemeter upon moving targets; forming curtain of light, etc.

(g) Liaison between commander of sector and services engaged.

(The progress of the work is shown in the form of a daily diary which does not permit of condensation.)

[Our Annual Proficiency Test. By Capt. Jno. J. Boniface. *Jour. U. S. Cav. Assn.,* July, '17. 10,000 words.]

The practice and training obtained in our annual proficiency test (musketry) is invaluable, but it is unreasonable to judge an officer's qualifications to command an organization by one annual fifteen minute test.

In the fight at San Mateo, P. I., Aug 12, 1899, five companies of infantry and one troop of cavalry (700 rifles) made 23 target hits in the attack against 18 target hits by the 1000 enemy rifles from an entrenched position. Our troops fired about 60 rounds per man.

The School of Musketry tests for averages are carried out under every advantage of daily practice and much study of details, and take account of musketry results only. The tactical handling of the proficiency test should be included in the final rating.

Under ideal conditions on the "B" range, there are many conditions to be met (31 are mentioned), but none of these can be omitted. Does the instruction and record combat practice lead up to this annual fifteen-minute test sufficiently to give a good officer a fair chance in the test?

If the monthly combat practice now required could be made a monthly proficiency test, and the ammunition now used in long range firing could be so used, far higher results would be shown next year. In the meantime the School of Musketry pamphlets would be available as a guide for training.

(A description of the annual proficiency test as executed by several organizations, with the resulting rating,—three regiments unsatisfactory and one satisfactory. The author describes at length the test of his own troop, including errors of omission and commission.)

Any test that shows two-thirds of the units "unsatisfactory" must be poor. No officer will acknowledge that a rating of "unsatisfactory" based upon a single fifteen-minute annual test shows his real ability to handle his organization in a fight.

The points of combat training should be more fully discussed. Much benefit was derived from the discussion of a tactical problem given out, and similar good would be derived by discussion of combat firing problems.

The author took his troop thru a repetition of the movements of the annual proficiency test with great benefit to all concerned, even though no ammunition was used. The benefit was greater than that of the proficiency test itself. If ammunition could be provided or saved, the benefit of such practice would be much greater.

Proficiency tests should not be a mysterious secret test, but a part of the regular training. By practice, the organization commander would learn to pay attention to the many details that must engage his attention in firing under strange conditions.

Our target practice should avoid any tendency to secure a high *paper* record at the expense of real efficiency in firing. The organization which fires in all kinds of weather is better prepared for battle firing than one which fires only when weather conditions are favorable, but its paper record will not be so good.

—Instruction and Training

See also

CAVALRY—FIRE—INSTRUCTION AND TRAINING
FORT RILEY MOUNTED SERVICE SCHOOL

[Training National Guard Cavalry. By Capt. George Grunert, 3rd Cavalry. *Jour. U. S. Cav. Assn.*, July, '17. 9000 words. Program and schedule of instruction.]

(The author had devised a scheme for the rapid instruction of National Guard cavalry, based upon a pamphlet, "Preparing for a Campaign in Twenty Days," by Major (now Colonel) F. C. Marshall, 15th Cavalry. The assumption that the peace strength of National Guard cavalry regiments would be partially trained, with equipment for war strength, proved to be erroneous. The notes on this scheme of instruction proved of great value to the author when assigned as inspector-instrucor of the First Illinois Cavalry on July 6, 1916, as there was still at that time the possibility of a call at any time for duty in Mexico.

After quoting certain extracts from his notes relative to duties and responsibilities of officers and non-commissioned officers, the author outlines certain principles to be adhered to in all drills as to manner of giving commands, the necessity for variety with repetition at drill, the need for knowing what is correct and making instant correction of mistakes and particularly the need for a definite plan and thorough preparation for drill.)

Men of below ordinary capacity should be utilized for minor duties for which their intelligence is sufficient. Control of the troop should be secured by the cultivation of esprit rather than by a multiplicity of orders governing their actions. Unswerving partiality must be observed.

The regiment was found to contain a large number of recruits, and more than half had had no experience in camp. There was a large shortage of equipment, and much work remained to make the camp habitable in wet weather.

Pending the arrival of the horses, discipline and dismounted instruction occupied attention. The general plan of instruction was to see that the officers were familiar with their duties and the non-commissioned officers properly instructed by means of schools and to pursue a full schedule of drills under a definite program. Promptness and full attendance at drills were required.

The horses arrived in driblets and were hardened under a program of exercise calling for ten miles at a walk each day the first week, alternating trot and walk in five minute periods each day the second week, and practice marches with packed saddles the third week. Suitable rest periods were provided and instruction in troop leading was given in connection with the horse exercise.

(Schedules of horse training and instruction, each covering one week, are given. The latter includes a problem. Uniformity of instruction was secured by definite and detailed programs and schedules of exercises, published each week.)

One great difficulty was due to the fact that the horseshoer's union of Chicago had forbidden its members to enlist in the National Guard unless they received the proper wages. As a consequence, the regiment had but two horseshoers and others had to be trained.

Theoretical and practical instruction were given in first aid, sanitation, signalling, interior economy, Spanish, etc. A special regimental scout detachment was organized and trained. This detachment explored the country for 20 miles around. The basis of the instruction was McKinney's "Scout Manual," and the work covered all the fundamentals of scouting, night work, and day and night contests.

One opportunity occurred for regimental drills, which was something new to both officers and men.

Argentina

[Programs of Instruction; General Program for Recruit Period of Cavalry. By Capt. Brollo, G. S. *Rev. del Circulo Militar*, Dec, '16. 1200 words. (To be continued.)]

The program should embrace all the instruction necessary to prepare the recruit for service in the squadron and the prescribed courses for officers and non-commissioned officers.

The general program should be prepared by regimental headquarters and detailed schedules worked out by the squadrons to carry it into effect.

The several branches of instruction may be grouped under three heads:

1. Instruction dismounted.
2. Instruction mounted.
3. Theoretical instruction by conferences and lectures to supplement practical work and to acquaint the recruit with his obligations and rights and the customs of the service.

(Here follows a daily program for the instruction of officers as prepared by regimental headquarters covering the months of January to May inclusive, and embracing equitation, swimming, gymnasium, tactical problems and exercises on the map, war games and short conferences on subjects or organization, administration, discipline, etc.)

[On Programs of Instruction. By Capt. Brollo, G. S. *Rev. del Circulo Militar*, Jan, '17. 1800 words.] (To be continued.)

(Continues outline of program of instruction for officers for the month of May.)

The monthly schedule should provide for possible interruptions due to weather conditions or other exigencies, and should be arranged with due regard for the convenience of the officers.

The Troop.—While not required by the regulations, a program should be mapped out for the instruction of non-commissioned officers and candidates. This should include a general course of study embracing reading, writing, arithmetic, history and geography, and a military course analogous to that given to officers.

Recruits.—(Gives in detail, with reference to specific paragraphs of the regulations, the subjects in which the recruits must be instructed.)

Theoretical instruction in equitation, rifle fire, field service, etc., should be carried on as a necessary com-

CAVALRY—Continued

plement to the practical exercises, and in addition, instruction should be given by lecture on the following subjects:

Duties of the soldier on detached service.

Names of immediate superiors and of high military authorities.

Internal services of the squadron and regiment.

Insignia of rank, marks of respect, etc.

National history including the origin of the flag, shield, and national hymn, names of famous statesmen and military men, special feats of arms and particular acts of heroism of individual soldiers, and a brief sketch of the regiment.

Physical geography of the State; limits and boundaries, frontiers, means of communication, internal and external, productions, etc.

Difference between military offenses and crimes, legal penalties for insubordination, desertion, theft, robbery, acts of violence.

Importance of universal military service.

Duties of the reservist; civil duties.

Special classes should be held in each squadron for cooks, blacksmiths, tailors, shoemakers, and farriers and in the regiment for instruction of musicians and the band, and for the telegraph patrol.

—Instruction and Training—Schools

[School of Military Equitation. By S. B. *Memorial de Caballería,* July, '16. 2700 words.]

A description of the School is given under the following headings: Foundation; Establishment in Madrid; Plant; Personnel; Creation of the New Spanish School; Regulations of Equitation; Regulation Equipment; and Technical Missions.

The School was founded by royal order of Dec 3, 1902, Captain General Weyler then being Minister of War. It was located in Madrid for professional, economical and social reasons.

The staff and corps of instructors consist of 1 colonel, 3 lieutenant-colonels, 2 majors, 4 captains and 6 1st lieutenants of the cavalry arm; 1 major and 1 captain of artillery, instructors in explosives, and 2 medical officers, 1 veterinarian, 1 chaplain and 1 fencing master. Student officers receive a gratuity to compensate them for the extra expense of equipment, uniforms and other items.

Officers who make marks of from 7 to 10 points only during the course are sent back to their regiments at its conclusion. Those who make 10 points or higher get a three months' leave and the cross of military merit. Those who make 15 points or higher, take the second course and the officer qualifying as number one of his class receives a special recompense. In the second year's course, the officers who make 15 points or higher receive this special recompense.

Between 1903 and 1916 inclusive, 384 officers completed the course. The rigorous selection of officers, and the exacting physical requirements of the course produce a corps of alumni who are capable of enduring the labors and hardships of the most severe campaign.

—Organization

[About Organization. By Two Captains. *Memorial de Caballería,* June, '17. 1620 words.]

(A plea for the organization of cavalry in independent divisions.)

The principal arm of the cavalryman is his horse. The fire of the cavalry is a means, not an end. The cavalry unit of combat is the division. The power of the division lies first in its mass and second in the fire of its machine guns and artillery. Cavalry is for a war of movement.

For years theorists have denied the efficacy of the charge. Now that infantry charges under a deluge of machine gun fire and hand grenades, cavalry shock action can no longer be looked upon as a thing of the past. The anti-aircraft artillery of the cavalry divisions would give aerial security to the army.

A new orientation is necessary for the cavalry. Its organization into independent divisions is imperative.

[Cavalry Organization. By Two Captains. *Memorial de Caballería,* Aug, '17. 3600 words. (Continuation.)]

The unit of combat in the cavalry, is the division. Acting alone, it is a small army, mobile and flexible, with an adventurous spirit ready at all times to take advantage of favorable opportunities for concentrated action. It serves as a base from which small groups radiate on daring explorations towards the enemy. Acting with other troops, it protects them at all times, and if necessary, sacrifices itself for their safety.

The characteristics of cavalry combat are such that constant practice in command is necessary for division commanders. The maneuvers of September and October, do not afford sufficient time for instruction of officers, and a radical reform in the training system should be made.

Unity of instruction is of primary importance. The present scheme of instruction does not provide for this, and it may be said that the cavalry arm is the most backward of all. Faulty organization and lack of command are largely responsible for deficiency in instruction. A cavalry division should be organized for each army corps, and the commanding general of each division charged with standardizing and coordinating the instruction of his troops.

It is impossible for officers to learn to command cavalry by theoretical study only.

(Continued.)

Argentina

[Opinions on Cavalry, Contribution to the Study of Its Organization. By Lieut. De Vera. *Rev. del Círculo Militar,* Feb, '17. 2000 words.]

In previous articles published in this magazine (March, April and May) were outlined the successive steps leading up to the present organization and methods of instruction in the two greatest schools of cavalry, Germany and France.

The arguments on which this development was founded being thoroly reasonable, they should be our

guide in considering the special organization to be given to our own cavalry.

We should begin by abandoning the cumbersome formations and complex organizations adopted from foreign sources, and which at every maneuver have shown their unsuitability, and plan our organization to fit the special conditions of our own terrain, our resources, the characteristics of our people and of our probable enemies.

The South American terrain with its extensive frontiers lends itself particularly to surprise operations and the arm best adapted to this service is cavalry.

The great virtue of cavalry is mobility and freedom of action; it must be able to pounce upon the enemy unaware and by its unexpected appearance at far distant points keep him intimidated and hamper his initiative.

To secure this freedom of action the organization must be simple, flexible and easily handled; it must not be burdened with slow moving supply trains but must expect, and be prepared, to live off the country.

All the conditions favorable to the other arms are also favorable for cavalry while those factors which hinder the action of the other arms (difficult country, poor communications, etc.) will present the best opportunities for successful surprise action by the cavalry.

Spain

[Cavalry. By Augustine de Quinto. *Memorial de Caballería,* Mar, '17. 2000 words.]

In the majority of the armies of Europe, cavalry is organized for independent action. Whether it be occupied in strategic reconnaissance or in the closest form of security work for columns, it must be allowed certain liberty of action to develop efficaciously the missions that are peculiarly its own.

Altho it is true that small fractions are indispensable to the other arms for the performance of specified duties, this service cannot be taken into account in providing for the organization and instruction of cavalry.

The distinction of two groups: one divisional, the other independent, would exact logically a difference of armament and tactical applications. This would be a grave defect that would satisfy no technical necessity, but on the contrary would complicate the organism and destroy its harmony. These reasons have doubtless caused the organization given to the cavalry of European armies in time of peace.

[A brief description of cavalry organization in 1913 follows.] To summarize: of seventeen states, the seven strongest and most carefully organized group the cavalry in time of peace into independent units and from these units *take for war* the divisional cavalry. The remainder, exclusive of those of the Iberican Peninsula, group their squadrons in units in no way related to the other arms.

The suggestion is made that the Spanish cavalry be organized in nine brigades as follows:

(1) Regiments 2d, 19th and 20th; headquarters, Madrid.

(2) Regiments 3d, 23d and 27th; headquarters, Aranjuez.

(3) Regiments 8th, 12th and 21st; headquarters, Córdoba.

(4) Regiments 6th, 22d and 26th; headquarters, Valencia.

(5) Regiments 9th, 10th and 11th; headquarters, Barcelona.

(6) Regiments 1st, 17th and 18th; headquarters, Zaragoza.

(7) Regiments 4th, 7th and 13th; headquarters, Burgos.

(8) Regiments 5th, 15th and 16th; headquarters, Valladolid.

(9) Regiments 24th and 25th; headquarters, León.

—Reconnaissance and Scouting

See also
CARRIZAL, ACTION AT
OJOS AZULES, ACTION AT

[Cavalry and Aviation. By J. de Elola. *Memorial de Caballería,* Aug, '17. 1500 words. (Continuation.)]

One disadvantage under which cavalry labors in modern war is, that it is difficult and often impossible for it to make reconnaissance in depth. On the other hand it is often possible for patrols secretly to reach commanding positions from which they can see without being seen. Information secured in this way may be as accurate as that furnished by aviators. A well-trained observer who knows the organization of the enemy's army can tell by the composition and formation of the elements of a marching column whether it constitutes a brigade, division or army corps; this even when fractions only of the column can be seen. Reconnaissance by airplane could give but little more information. The moment an airplane takes the air its presence is signalled from hundreds of places. An airplane cannot hide except in clouds, in which case hostile movements cannot be observed from it. Once seen by the enemy the airplane becomes the object of attack by hostile aircraft which it must defeat before it can reconnoiter.

In this respect reconnaissance by aircraft is similar to that by cavalry as in both cases ascendency over the hostile units of the same arm must be gained as a preliminary to complete reconnaissance.

Cavalry is favored in that before the shock of meeting takes place the diversity of the terrain offers opportunities for ambuscades, strategems, envelopments, etc. Generally these opportunities are denied to aircraft.

In the case of discovery and pursuit by the enemy after the completion of a reconnaissance, the aviator has no hope other than in the speed of his motor. If his motor is better than those of his pursuers, escape is probable; otherwise, there being no place to hide, capture or death is certain. A detachment of cavalry discovered and pursued may not only depend for safety upon the speed of the horses, but may adopt various measures to confuse, delay, and punish the pursuers—use of the ground being limited only by the astuteness of the commander.

CAVALRY—Continued

One lucky shot may destroy an airplane, but it is hardly possible that every member of a properly conducted cavalry patrol could be killed or captured.

Seidlitz, the great cavalry leader, stated that a good cavalry officer on reconnaissance duty, could not be taken prisoner, and demonstrated by his own acts the truth of his statement.

(Continued.)

—Service Regulations

United States

See also

CAVALRY—DRILL REGULATIONS—UNITED STATES

—Special Duties

[Theme. Should Our Cavalry be Given Bridge Equipment? What Should It Be? By Capt. Betnaza. *Revista Militar,* Nov, '16. 1800 words.]

(A brief description is given of the bridge equipment for cavalry used in the French, Austrian and German armies.

The writer concludes that Argentine cavalry should be equipped with bridge material, and that the Austrian system, with certain modifications to suit the probable theater of operations of this cavalry, should be adopted.)

—Tactical Rides

[A Tactical Ride. *Memorial de Caballeria,* Aug and and Sept, '16. 4100 words. 4 tables, 1 map, 3 illustrations.]

(This is an account of the preparations made and orders issued, for a tactical ride by the higher commanders of a corps of 2 divisions and one independent cavalry brigade, in the vicinity of Bilboa under the direction of General the Marquis of San Juan de Puerto Rico. The ride was scheduled to last from May 22 to May 25 inclusive. The instructions of the director prohibit "consultations" by unit commanders upon receipt of field orders. The tables show the organization of the cavalry brigade.)

This ride took place in May in the 6th Military Region thru the mountainous district east of Bilboa. Those taking it were the colonels and higher officers of a corps and of an independent cavalry brigade. The operations of the cavalry are shown in detail. The cavalry brigade covered a front of over 40 kilometers. At times, in order properly to protect the army corps, officers' patrols covered distances of from 60 to 70 kilometers and the central mass of the brigade was reduced temporarily to three squadrons only. Marked activity and zeal on the part of the colonels was noticed. In some cases these senior officers rode with patrols over mountain trails for 40 or more kilometers in one day. It is regretted that economic reasons prevented the attendance of squadron commanders.

[The Cazadores Regiment of Victoria Eugenia (22° Cavalry.) A March Made by Three Officers and One Orderly. By A. D. *Memorial de Caballeria,* Sept, '16. 2000 words.]

Three officers of this regiment, accompanied by one orderly, made a series of marches during March and April that merit attention. The officers rode their own mounts. During the preparatory period, 530 kilometers were traveled. A *raid* of 330 kilometers was then made in three marches, the first of 165 kilometers in 25 hours; the second march was of 55 kilometers, and the third of 110 kilometers, the whole taking seven complete days of which four and a half were spent in rest. Altogether 860 kilometers were traveled without accident or incident. The horses were in good condition at the end of the *raid* and were used by the officers at regimental drill two days after the return.

The itineraries and other interesting data referring to the marches were published by the Regiment in a small book. The first stage of the *raid,* when 165 kilometers were covered in 25 hours, was spent, 17 hours in marching, and 8 hours in resting. During the 17 hours of marching the gaits were as follows: walk, 552 minutes; trot, 432 minutes; gallop, 18 minutes. The regulation equipment was used.

—Tactics

[Letter of Captain General the Marquis of Teneriffe (General Weyler). *Memorial de Caballeria,* Dec, '16. 1400 words.]

General Weyler expresses his affection for the cavalry, the arm which he entered as a cadet, and outlines his conception of the true rôle of cavalry in modern war. The great advances in arts and sciences are reflected in improvements of instruments of warfare.

The efficacy of fire at longer ranges has materially changed tactical methods. Charges in great masses are no longer frequent. Cavalry missions now are to gain contact with the enemy; to screen and to reconnoiter; to protect infantry and artillery in critical moments; to maintain communication between sectors of the battlefield; to ascertain hostile intentions and movements; to seize positions of consequence and with the aid of horse artillery and machine guns, to hold them until other troops arrive; to make raids; lastly and most important, to consummate a victory or cover a withdrawal. The present war of trenches is merely a strategical phase of the conflict. A decision can be effected only by combat—and for combat the action of cavalry is indispensable.

—Use of in European War

[Investigations Concerning Cavalry, Based on Actual Observations of the European War. By Lieuts. of Cav. Miyoshi, Morimoto and Motoda. *Kaikosha Kiji,* May, '16. 2300 words.]

1. Concerning the German cavalry used against France, England and Belgium. General important points. From the opening of the war to the first engagement. The general policy of the Germans was to leave the Russian army to the Austrians and to throw their whole force, with a small exception, against the French army in Belgium and France. A cavalry force was formed from the cavalry of three divisions, and crossing the frontier on the third of August, in the neighborhood of the Aisne, (?) advanced towards Liège and by the evening of the fourth arrived in front of the forts. On the following day they attacked the forts

and succeeded in taking one or two of them, but sustained great losses and obtained no results. There is a report to the effect that this cavalry was destroyed, tho this report is not clear in detail. The advancing army of the Germans then waited before these fortifications pending the arrival of the big guns, and the cavalry of this army were moved and assigned to the duty of cutting off the line of communications to Brussels and later to occupy the station of Rouen. (?)

2. This section of the article deals with the operations of the French cavalry during the action of the Marne.

The writers, as a result of their observations of the above and other instances, think that the use of cavalry has not changed to any great extent, and that it is valuable mostly for observation work and advance actions in front of the main force.

The formations of cavalry on the march are also dealt with in the conclusion of the article.

[Study on Cavalry. By Lt.-Col. H. Poudret. *Rev. Mil. Suisse,* Feb, '17. 6000 words. 3 maps.]

Tho it is difficult to collect detailed and accurate information on cavalry operations in this war, I have undertaken this investigation because I believe the legend of the "cavalry's failure" should not be allowed to persist. A great deal has been heard about this "failure," especially among us, tho it is difficult to discover what interest anyone could have in convincing an arm of its lack of value.

In spite of the obscurity of which I have just spoken, enough is, however, known to permit the statement that, wherever it has been well used, the cavalry has done all that could be expected of it and sometimes even more.

* * * * * *

When the war broke out, many questions naturally suggested themselves as to the probable use of cavalry. Should we see great raids by strong bodies of cavalry with their horse artillery, their pioneer telegraphists, their cyclists, their radiotelegraphic stations, their trains of auto trucks, raids especially recommended by General von Bernhardi, who was hypnotized by old memories of the War of Secession? On the other hand, should we be likely to see the cavalry working according to opposite ideas, at a short distance from the infantry, in intimate contact with it, in the combat of the three arms, to use an expression which two years of war have already made obsolete?

And reconnaissance? Would it be done by means of squadrons or, according to the old method, by patrols? Would it be possible still, as at the beginning of 1870, to push the elements of this arm far forward or would the new progress of armament compel the cavalry to work only at short distances?

And then, there was the great question of the mounted attack, close to the heart of so many cavalrymen.

Finally, it might be asked how the cavalry would behave in the dismounted combat. Its instruction had not been pursued everywhere with much care. Would it be enough for the task?

The answer has come to all these questions. All the eventualities foreseen have come to pass, naturally in varying degrees.

With the cavalry of General Sordet in Belgium and the German cavalry on the Russian front, we find great raids.

We find the cavalry sometimes preceding the armies by great bounds, sometimes working in direct contact with its infantry, at short distances.

We find it actively used on the battlefield itself, that of the Marne, for example.

Numerous mounted attacks have taken place. The cavalry of General Brussilof has showed us pursuits on a large scale, such as the most ardent cavalrymen did not dare dream of.

Finally, as was foreseen, there has been much fighting on foot.

But let us not anticipate. Let us look into things a little more closely, beginning with the German cavalry on the Western front, about which we have the most information. I shall confine myself to the cavalry corps of the I and II armies, because these corps of the marching flanks, had, naturally, the greatest and most interesting activity.

* * * * * *

On the morning of Aug 4, 1914, preceding the right wing of the army of invasion, two divisions of cavalry (2d and 4th) of von Marwitz's corps, crossed the Belgian frontier east of Gemmenich, skirted the Dutch frontier and moved on Visé, north of Liége, intending to force the crossing of the Meuse there.

They found the bridge destroyed and the crossing guarded by a battalion of infantry. The latter, favored by the nature of the terrain, stood off all attacks, in spite of its small numbers.

Checked here, the German cavalry rapidly adopted another plan, recommended by their mobility and their acquaintance with a terrain probably long since known to them. A brigade of hussars was sent to the ford at Lixhé, below Visé, and succeeded in crossing it. Not only did the Belgian troops guarding the crossing at Visé find their left turned (the effect of which was to make them withdraw to the line of the forts of Liége), but this first crossing of the invaders to the left bank of the river opened the roads to Antwerp and Brussels to exploration. As soon as the Visé bridge was restored and some bridges at Lixhé constructed, an entrance was prepared for the German columns which later sought to cut off the Belgian army established on the Gette from its base at Antwerp. The task of the first day was thus accomplished and in a relatively short period of time.

During this first day, Aug 4th, the German cavalry is not very far ahead of the infantry advance guards. This is easily explained by the proximity of the frontier. Besides, the Germans do not seem to have applied any rigid system in this matter of distance. Sometimes the cavalry is kept close, sometimes it is given free rein. On the Western front, its marches were only rarely very long. The necessity of having at hand his powerful auxiliaries the battalions of chasseurs and the horse artillery tend to prevent the com-

CAVALRY—Continued

mander of cavalry divisions from going too fast. If I emphasize this point, rather interesting in itself, it is because this course was not followed everywhere.

The 2d and 4th cavalry divisions were not the only ones to cross the Belgian frontier on the morning of Aug 4th. Further to the south, coming probably from around Malmédy, the 9th division, belonging also to von Marwitz's corps, crossed the Salm between Stavelot and Viel-Salm and marched towards Marche, west of the Ourthe; it reached Marche on the 6th. We have less information about its activity and its mission. We may suppose that it had to cover the concentration of the Third and Fourth Armies at Saint-Vith and north of that place, then during the investment and attack of Liége, to cover those operations towards the west. It was perhaps with advanced elements of this division that the Belgian lancers were engaged on the 5th at Plaineveau, south of Liége.

On the 14th, the 9th division having become superfluous south of the Meuse when the 1st cavalry corps (Guard and 5th division) arrived, crossed the river and joined the 4th cavalry division in the region of Gembloux-Wavre. These two operated together until the 18th.

The Belgian army which, on the 6th, was on the concentration quadrilateral Tirlemont-Louvain-Wavre-Perwez, took up positions along the Gette. The left flank rested on the Demer, the right flank at Jodoigne was somewhat protected by the forts of Namur, but, after all, not very efficaciously. The distance to the Meuse is fairly great, and the adversary might well be tempted to send troops thru the gap. The Germans concentrated an enormous mass in front of the Belgian army. About Aug 18th there were about 11 army corps there.

The mission of the German cavalry, during this period, is quite evident. It had to mask the movements of the armies and to operate on the enemy's flanks. The first of these tasks was quite easily accomplished, thanks to the overwhelming numerical superiority of the German cavalry. But operations on the enemy's flanks were not so easy. The first attempts were against the Belgian left. They were not always successful at the beginning.

On Aug 10th, the 2d and 4th divisions pushed, with a part of their forces at least, to the Velpe, between Diest and Tirlemont. This movement does not appear to have succeeded, for on the 11th, we find these divisions at Hasselt. On the 12th there was an undoubted check. Six regiments from the same divisions tried to force a crossing of the Gette at Haelen. They were supported by two battalions of chasseurs and three batteries, that is 4000 cavalry, 2000 infantry and 18 guns. The Belgian cavalry division could oppose them with only 2400 troopers, 400 cyclists and 12 guns. The Germans began their attack about 8 o'clock in the morning, the cavalry being dismounted for the most part. For two hours two companies of cyclists stood them off. About 10 o'clock, German artillery fire made the edges of the village of Haelen untenable, the cyclists then blew up the bridge and retired to the railroad.

At noon the Germans attacked simultaneously Zelk and Haelen station. The cyclists fell back towards the main Belgian position at the farm of Yserbeeck. Twice they were charged by the German dragoons, who suffered great losses.

Finally the Yserbeeck farm was taken, and the situation appeared hopeless for the Belgians. At this moment, the 4th Belgian mixed brigade arrived on the field after a march of 25 kilometers. Their appearance turned the scale. From then on, the Germans could make no progress, and they fell back to Haelen.

After this check, the rôle assigned at first to the 4th division was no doubt changed, for we find it, on the 16th, about Gembloux and Wavre. It is probable that this division and the 9th were covering the march of the III, VII and IX corps, which had crossed the Meuse between Liége and Huy and were marching towards the interval between Jodoigne and Namur. The German and French cavalry met near Perwez, and the French seem to have had the worst of the combat.

The German cavalry took an active part in the fight at Tirlemont, on the 18th. This was a critical day for the Belgian army. Pressed in front by overwhelming numbers and with its flanks turned, it could not hold any longer on the Gette. Its left between Diest and Tirlemont, was approached by three army corps. The 2d cavalry division flanked the movement by advancing between the Grande-Nèthe and the Demer. Elements of that division were at Aerschot, north of Louvain, on the evening of the 19th.

A little more, and communication with Antwerp, the army's base, would have been cut off. A retirement to the Dyle was first accomplished and when it was found that this was not sufficient to escape envelopment, the retreat on Antwerp was ordered.

To finish with this phase, as far as we can find out, the 9th cavalry division followed the Belgian retreat thru Ottignies to Brussels. It went thru the latter city without stopping on the 20th and continued its march towards the west.

The 2d cavalry division seems to have continued its functions as flank guard on the extreme right; it covered the right flank of the I army which was marching on Brussels. This division then went in the direction of Ostend; we find it at Alost on the 21st exploring towards Ghent, while the 9th division was reconnoitering in front of the I army. We lost track of the 4th division; it is probable that it continued to operate with the 9th division.

During the operations north of Liége, a large body of cavalry appeared in the Condroz, the region south of Liége. This corps was made up of the Guard cavalry division and the 5th cavalry division. It was concentrated at Bithburg, north of Trèves, and marched thru the Ardennes forest, with the mission of reconnoitering the line of the Meuse about Dinant. It reached La Roche on the other side of the Ardennes

on the 11th August. The patrols which scoured the country skirmished with more or less success with the advanced elements of the French cavalry corps of Sordet, which had arrived on the Ourthe about the 7th or 8th. Except in one instance the German patrols were not able to reach the Meuse.

In order to find out what was going on along the line Namur-Givet and probably also in order to open the way for the XII Saxon Corps, the commander decided to attempt, on Aug 15th, a reconnaissance in force of Dinant, from the direction of Ciney. After temporary success, the Germans were repulsed by the troops of the 1st French corps which had arrived only a little while before. General von Richthofen did not insist. On the 19th, he gave up his place to the XII Saxon Corps, which took up the operation on its own account.

Thus on the two flanks, at Haelen and Dinant, the attempts of the German cavalry fail almost simultaneously, Aug 12th and 15th. The attack on the Meuse was a serious undertaking. It will always be difficult even for a strong cavalry body to force a crossing so naturally strong and defended by a good sized body of troops of all arms.

The check to von Marwitz's cavalry on the right wing is not so comprehensible. One may wonder whether, if he had been less insistent on crossing at Haelen, he might not have succeeded. Zelk was feebly defended and the movement on that point might have been developed more.

Upon leaving the region of Dinant, von Richthofen's corps was ordered to cover the left flank of the XI Saxon Corps which was marching upon Namur. They marched around this place and reached the vicinity of Charleroi on the 23d, as the battle was ending.

While the battle of Charleroi was going on there were five divisions of cavalry north of the Sambre-Meuse.

The 2d division on the right bank of the Dender, reconnoitering in the direction of Lille;

The 4th and 9th, in the region of Tournai-Condé on the Scheldt;

The Guard and 5th, south of the preceding and farther to the rear.

On the 24th, the advanced elements of these divisions are on the line Pitthen (north of Tournai)—Tourcoing-Lannoy, as well as south of Lille and near Douay.

From the moment on, it is rather difficult to describe with exactness the activity of these cavalry masses. We may suppose, however, that the right wing turned to the south, for, on the 25th we find a large part of von Marwitz's corps near Cambrai.

About the same time, von Richthofen's corps crossed the French frontier at Sars-Poteries.

The German cavalry is entering on a brilliant period! The enemy beaten at Mons and Charleroi, is retiring to the south. The object is to cling to him and not give him any rest; the marches are lengthened so as to push the rear-guards. The cavalry has its own infantry on its heels. The latter is advancing by forced marches, especially on the German right. The result is a great inequality as to distances, and cavalry and infantry are frequently abreast of each other.

Von Marwitz's cavalry, still on the right flank, pushed from Cambrai to Marcoing, which it reached the 26th. From there it reconnoitered towards Combles and Péronne. On the 29th, it was reported at Albert, on the 30th near Roye. If this itinerary is correct, we may deduce from it that the troopers of von Marwitz covered the front and right flank of the Second Corps, itself the extreme right element of the First Army.

In the night of Aug 31-Sept 1, the cavalry of the First Army went thru the forest of Compiègne in two columns. In the morning, they had a serious engagement with the English rear-guards on the south edge of the forest. The division lost half of its artillery and was roughly handled, so much so that next day it could not take part in a fight which the 2d and 9th divisions, co-operating with advanced troops of the Second and Fourth Army Corps, had near Senlis.

It is probable that the circumstances of this check to the 4th cavalry division were as follows. On the evening of the 31st, a body of 4000 English troops of all arms coming from the direction of Compiègne, arrived at Néry, a little town south of the Oise. Very well received by the inhabitants, the officers dined till a late hour and seem to have neglected the measures of security indicated by the circumstances and the dangerous proximity of the forest of Compiègne. Warnings were not lacking, however; civilians reported late in the evening that the forest was full of Germans. At five-thirty in the morning, when the batteries were ready to leave, the first shrapnel burst unexpectedly in the village, accompanied by the rifle fire of skirmishers who had approached very close, thanks to the mist and the lack of the service of security. The losses were very great. Many artillery team horses were hit. The English officers, many of whom were hardly equipped, made up for their carelessness by great decision and bravery. After a moment of extreme confusion, the English got themselves together. In spite of the loss of many of their officers, they counter-attacked vigorously. The hussars, most of whose horses had been killed, deployed on foot. The German skirmishers were driven back. The English pushed as far as the artillery position, captured 8 guns and threw the supports back in great disorder. This offensive was so vigorously conducted that the necessary time for a withdrawal was gained. It was only after the departure of the English and the forcing of the Oise more to the west that the Germans were able to occupy Néry.

On Sept 4, the 2d and 9th divisions participated in the change of direction to the southeast of General von Kluck's army and marched to La Ferté-sous-Jouarre on the Marne. The 4th, still suffering from the effects of the Néry fight, probably was assigned to the flank-guard corps, the Fourth Reserve, which stayed north of Meaux.

CAVALRY—Continued

On Sept 5, the 2d and 9th divisions continued their march to the south, went thru Coulommiers and moved towards Provins. Towards noon, it was ordered to stop. It is probable that they passed the night in the sector of the Fourth Corps, at Coulommiers, or in the immediate vicinity, for that is where it is known to have been engaged on the morning of the 6th. The battle of the Marne was about to begin.

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Almost on a line with von Marwitz's corps and on its left, operated the cavalry of Richthofen. Its mission was to pursue the English retreating from Mons.

This pursuit leads to daily combats with the enemy's rearguards. There is fighting first at Haulchin, at Givry, then at Marbois, which is taken by assault and where 100 prisoners are taken. The chief of staff of the corps is killed in this fight. Meantime, patrols are sent out on a wide front and generally to great distances. Their strength varies a great deal, from a dozen men to a platoon. One of them, sent towards Saint-Quentin, attacked, according to the German account, a platoon of cuirassiers which it put to flight, killing six men and five horses.

On the 28th, another fight at Urvillers and around Saint-Quentin. A French territorial regiment, which had arrived that morning only, was roughly handled there and left many prisoners with the troopers of the Guard. Reinforcements from La Fère and an attack by a squadron of English hussars, which bowled over a German squadron, did not succeed, however, in turning the issue of the fight.

The 29th, Golancourt, south of Ham, was taken and then an attack by the dragoons of the Guard prevented the English from stopping at Guiscard.

This corps has now arrived in the region of important water courses, and a squadron is sent to reconnoiter the crossing of the Oise and the Aisne.

On the 30th, Richthofen's corps arrived before Noyon. The patrols had not been able to find out whether the enemy was disposed to defend the city nor whether the Oise bridges were still intact. A party of mounted troops and cyclists was sent to develop the situation. The cyclists were instructed to rush the attack on the river crossings. The city was not defended and strangely enough a bridge was found intact. The corps was able then to cross there and at Ribecourt and to move, the same day, to the region south of La Fère, moving on Soissons. That day, a lieutenant succeeded in seriously damaging the Soissons-Paris railroad.

For Sept 1st, the cavalry received orders to move to the south thru Soissons and reconnoiter towards Château-Thierry. The taking of Soissons was not so easy as that of Noyon. All the patrols which advanced towards the city were met by fire and could not progress. One regiment of uhlans, a battalion of chasseurs, two batteries, and a detachment of pioneers were sent forward to seize the crossings of the Aisne. The chasseurs and pioneers entered the city first, ran to the bridges and arrived in time to prevent the destruction of the last, still intact. The French defended themselves in the barracks, but under the artillery fire they had to yield finally and the German squadrons began to go thru the city, while a certain number of squadrons, dismounted, searched the houses. The pursuit was continued that day as far as Branges, about 12 kilometers from Soissons.

On the 2d, the order arrived from Gen. von Bülow to cross the Marne at Jaulgonne. The advance guard went forward rapidly, supported by artillery and machine guns, it attacked on foot and succeeded in seizing the bridges before they were cut; then, without stopping, it gained the heights south of the river. Under this protection the main body was able to cross this important obstacle.

On Sept 4, the direction of march was Montmirail, but the cavalry corps could not advance on the roads; they were filled with the troops of the Seventh and Ninth Corps. In the formidable rush of the German armies towards the south, the infantry was keeping up its forced marches without any respite.

The First Army had indeed encountered resistance at Cambrai (the 26th); on the 28th, south of Bapaume (at Péronne, at Bellenglise) and at other places. The French army of Gen. Lanrezac tried on the 29th to check the march of the Tenth Corps at Guise and Saint-Quentin. But, on the whole, the advance had been very rapid. The cavalry, which opened the way and which had daily combats with the enemy's rearguards, was caught up with sometimes, on that account. There is nothing astonishing in that.

It was then across country that the cavalry gained the Petit-Morin between La Ferté-sous-Jouarre and Montmirail. It was now abreast of the heads of columns of the Second Army and on their right. It moved still further to the right on the 5th, in its march to the Grand-Morin and beyond. That evening the Guard was across the road from La Ferté-Gaucher to Provins, the 5th cavalry division to its right. These two divisions covered a front of about 5 kilometers. They were in this position when the great battle began. Before studying the rôle which they played in the battle of Marne, in co-operation with von Marwitz's cavalry, let us take a rapid survey of the activity displayed in the pursuit. On the whole, the difficulties were not great. The enemy's orders are almost always not to become seriously involved. If he resists too long, the artillery is called on to force him to leave. Besides, the cavalry has the comforting thought that the heads of the infantry columns are close behind and ready to support it. These are factors likely to give assurance to a cavalry that moreover, has proved in more difficult circumstances, that it had no lack of it. But, tho the task was not difficult, it must be admitted that it seems to have been well executed.

The cavalry of the First and Second Armies opened the way to its infantry, following the adversary closely everywhere. Nowhere was contact lost. The crossings of Aisne, the Oise, the Petit-Morin and the Grand-Morin were always occupied in time, thanks to the decision of the advance guards and sometimes even to the bold attacks of the few troopers in the point.

Where the bridges were found to be destroyed, the cavalry pioneers replaced them without delay, as at Noyon and over the Grand-Morin.

Reconnoitering, inasmuch as the cavalry can be made responsible for it—we shall see that that was not always the case—seems to have functioned well; in this prolonged pursuit, no surprise of large detachments is reported, and such an event might easily have come about in these circumstances.

The marches were 30 to 40 km. a day. Can it be asserted that the pursuit was not rapid enough? Daily fights, the anxiety of the cavalry commander to have all his troops well in hand, the numerous crossings of water courses, the numberless reconnaissances, slackened inevitably the forward movement.

In any case, thanks to the methods used, the German cavalry finds itself in the best possible condition to take part in the battle which is about to be fought. The horses are tired but not exhausted, the morale of the troopers is very high, the pursuit has intoxicated them, and then, are they not abreast of Paris? (Saddle sores seem, however, to have been quite numerous, which condition is not astonishing, considering the lack of rest. The big horses of the cuirassiers suffered more than the hussars' horses—this only confirms what is known of the greater endurance of smaller horses.)

The losses were not very great. The Germans attribute this fact to the extremely poor shooting of their adversaries; ill directed volleys did not make any great gaps in the ranks of the German cavalry. It must be said, in this regard, that the German commanders seem to have been fairly saving of their men, during this period, at least. As we have seen, when the enemy's resistance became too great, when it could be foreseen that the assault of a town or the attack of a position would be too costly, the artillery was brought up to clear out the place.

In fights for the possession of towns, we generally see the battalions of chasseurs engaged in front, squadrons on foot on the flanks, then mounted elements trying to envelop the enemy and even to gain the opposite end of the town by wide turning movements, thus cutting off the adversary's retreat. This maneuver, constantly repeated, resulted in a great number of prisoners for the German cavalry. With the advance guards, machine gunners and cyclists usually marched. Cyclists were also frequently assigned to patrols.

The Belgian and French reports often speak of German infantry being transported in auto-trucks so as to be able to accompany the cavalry. The German accounts make no mention of this, and it is probable that the battalions of chasseurs and carabineers kept up by marching on foot. This performance is the more remarkable because they were hardly sparingly used in the fights. They are found taking part in all engagements. As we shall see later, their losses were exceedingly large in the critical days of the battle of the Marne.

(To be continued.)

[A Cavalry Study (Continuation). By Lt.-Col. H. Poudret. *Rev. Mil. Suisse,* Mar, '17. 6500 words. 1 map.]

The German Cavalry at the Battle of the Marne

General von Kluck changed the direction of his march on Sept 4. He had been marching on Paris, a geographical objective, and now he aimed at the annihilation of the French armies. In so doing, he apparently obeyed a strategical principle recognized as correct. That would have been the case if Paris had really been nothing but a geographical objective. In reality, it represented something else and more than that. From its intrenched camp was to come out a menace, then a thrust more and more violent which was finally to thwart the German war plans.

General von Kluck's movement was ordered, or certainly at least approved, by the general headquarters, for such a decision was, in all probability, not left to the judgment alone of the chief of the First Army. This movement was justifiable only on condition of being cognizant of what was going on about the capital. Was General von Kluck ill informed by his cavalry? Did he not know of the concentration of the French Sixth Army? Finally, did he make a mistake not to leave all of von Marwitz's cavalry on his right flank when he obliqued towards Coulommiers?

I believe that these different questions may be answered in the negative. As to the first two, a detailed study will be worth while when it becomes possible. Not only because it will be interesting to know exactly under what conditions the march on Paris was abandoned, but also because rarely has cavalry found itself in presence of a reconnaissance mission more interesting or more full of responsibility.

The retreat of the Sixth French Army, former Army of the Somme, had brought it, on Sept 3, to the line Dammartin-Pontoise, where it stopped and faced north. It had before it von Kluck's army, extending from Creil to Nanteuil-le-Haudoin. This was the day the German high command decided to oblique to the southeast. General von Kluck could not have been ignorant of the presence of the Sixth Army supported on the intrenched camp of Paris. The cavalry was looking for it and must have found it. Its patrols looked in the right places. As early as Sept 1, they are present in this section. To tell the truth, the forests which bar the approaches of Paris over a wide front and to a great depth hindered them on the German right, where they are less numerous. One of them, however, arrived as far as Pontoise. More to the left, patrols gained Survilliers and thus had a favorable observatory. It is on the heights dominating the Senlis road and the railroad to Saint-Denis. Still further to the left, the obstacle of the forests does not exist, the terrain is open, the view extended. Therefore, patrols push far forward between the Saint-Denis railroad and the railroad to Nanteuil. As early as Sept 1, several squadrons passed thru Ermenenville. Langy-le-Sec was occupied on the 2nd. Patrols advanced on the highway to Paris towards Dammartin and Villeneuve.

CAVALRY—Continued

On the 4th, one of them even arrived almost as far as Gonesse. The vicinity of Meaux was not forgotten either.

Now, on Sept 4, upon learning of the German change of direction, General Galliéni ordered the Sixth Army to concentrate on their right. The French line extended then from Louvres to Tremblay-les-Gonesses. One of the wings included the highroad and railroad Paris-Nanteuil-le-Haudoin, and the other the Senlis road and the Saint-Denis railroad. These movements must have been observed, because we know that German patrols were in those localities. Independently of the news which he certainly obtained by other channels, General von Kluck must have been notified by his cavalry of the assembling of Maunoury's army.

Let us recall also that the Fourth German Reserve Corps was not surprised. It seems, indeed, that they fired the first cannon shots, about noon on the 5th, from the Monthyon heights, at a French battery leaving Yverny.

But, if General von Kluck was not ignorant of the presence of Mauoury's army on his right flank, he did not know its composition. But even a larger or more enterprising cavalry could not have given him that information. Another thing that the cavalry could not learn for him was that the enemy, far from believing itself beaten, was preparing for the most energetic offensive, with morale intact and faith in victory.

Neither could the cavalry announce that, in the days to come, new forces would come out of Paris, increasing the danger of which the germ was present on the first day of September. It was by not having foreseen this possibility or by not having attached any importance to it, it was by underestimating the adversary, that the German high command made its mistake. Its error lay in an erroneous interpretation of facts. Paris was to be neglected, because they were certain of entering it a week later! A flank march was to be made in front of the English who did not count any more after their eventful retreat, if indeed they had ever counted! The first attempt at an attack on the left flank, that begun by the Army of the Somme, had been easily repulsed. They no doubt thought that the second, if it happened, would be disposed of in the same way. Besides, such an attack was not very probable. Had not the government left Paris, and did not the German papers, always so exact, say that a revolution had started in the capital? To sum up, an error of judgment much more than lack of information. The cavalry cannot be blamed for these erroneous psychological assumptions.

We have seen that, of the three divisions of von Marwitz's corps, only the fourth had been left with the Fourth Reserve Corps on the Ourcq. We have no information of the activities of the Fourth Division during the battle, but it must have been sufficient for reconnaissance needs, great as they were. Would the presence of the entire corps have altered the issue of battle? That cannot be admitted. On the other hand, the skillful use of the cavalry south of the Marne, its services there from Sept 6-10, seem to prove that its distribution as ordered did not constitute an error.

And now let us see briefly—for we are not trying to rewrite the history of the battle of the Marne, what was the general situation, in the evening of Sept 5, on that part of the front which interests us—the German right wing. Besides, the whole interest of the battle is there. The strict exactness of this résumé cannot be guaranteed, for certain points are still obscure, in spite of all that has been written.

The movement begun on the 4th brought General von Kluck's army on the 5th along and south of the road from Crécy to Esternay. The right, formed by the Second Corps, faces the English army. Then come the Fourth Active Corps and the two cavalry divisions of von Marwitz, southeast of Coulommiers. Von Richthofen's cavalry corps is south of La Ferté-Gaucher, with the Third Army Corps on its left. The Ninth is at Esternay, with part of it more to the north, forming the left of the First Army.

General Bülow's army is not on the same line as the First, but less advanced. Its Tenth Reserve Corps is at Montmirail, the Tenth Active Corps and the Guard along the road from Montmirail to Châlons-sur-Marne, the left flank about Vertus. The Seventh Corps is kept in reserve north of Montmirail, from whence it will not stir for a long time.

Von Hausen's army extends from Vertus to south of Châlons-sur-Marne (Twelfth, Twelfth Reserve and Nineteenth Corps).

The French general in chief has given as the limits of the movement of withdrawal, the line of the Seine, the Aube and the region south of Bar-le-Duc. The Third and Fourth French armies are on the approximate line Bar-le-Duc-Vitry-le-François. The Ninth Army (General Foch) is concentrated in the region of La Fère-Champenoise, between Mailly and Sézanne, with an advanced division north of Sézanne. On its left, the Fifth Army goes from Sézanne to close to Villers-Saint-Georges.

The English army, which had gone too far south, is in the air; it will have difficulty in re-establishing the alignment on the following days. It has two corps along the Rozoy-Paris road and one near Lagny, resting on the Marne.

The parts, as we have just seen them, are noteworthy in this, their continuity is very marked. On the German side, there is a vacant space of more than 15 km. between the Fourth Reserve Corps and the Second Corps. This gap will go on growing as the enveloping movement of General von Kluck is accentuated. At the time of the march on Provins, the isolation of the Fourth Reserve Corps will be complete. That is where the danger lies, and this is the situation which the French general-in-chief is going to try and exploit. His famous order of Sept 4 demonstrates this clearly.

On the other hand, the hole between the Fifth French Army and the English is still greater. It is about 30 km. from Villers-Saint-Georges to Rozoy. Conneau's cavalry corps, south of the forest of Jouy,

is alone there to connect up. In this free space are the roads which lead from Coulommiers and La Ferté-Gaucher to Provins. It is there that General von Kluck is going to hurl the masses intended to envelop Franchet d'Espérey's army, without paying any attention to the English, whom he will leave on his right.

The directions of General Joffre are admirably clear. Maunoury's army will cross the Ourcq and advance towards Château-Thierry. The English will move in the direction of Montmirail, while the other French armies will attack straight in front of them, direction north. The German reserve corps will be in that way isolated and crushed, and the German communications threatened.

General von Kluck intends to contain the English with the Second Corps and bring the Fourth against the flank of Franchet d'Espérey's army.

Now that we know the plans, let us see the execution. In the idea of each of the two belligerents, the 6th was to be the first day of the fight. Some fighting took place on the Ourcq in the afternoon of the 5th, when Maunoury moved forward.

In spite of this menace, General von Kluck began the next morning his enveloping project south of the Marne. For that, the English had to be contained. This was the mission of the Second Corps which attacked violently early in the morning. During this time, the Fourth Active Corps advanced in two columns on the road from Coulommiers to Saint-Just and the road from Coulommiers to Provins. At eight o'clock in the morning, the advance guards reached the road from Melun to Provins. We shall see later that they did not get any further.

On the left of the Fourth Active Corps, advanced the cavalry of Richthofen. The 6000 troopers had been assembled south of Chartronges, on both sides of the Provins road. Five patrols were sent to blow up the railroad between Melun and Montereau. The distance to be covered was between 40 and 50 km., but it was hoped that, thanks to the space left free between the English and the Fifth French Army, the patrols would be able to reach their objective. It did not work out that way. Two of them returned in the course of the day without having been able to get thru, the other three were captured.

The corps set out for Provins full of confidence. They thought that they were bound for the decisive action that was to bring the end of the campaign. An officer of high rank had announced that they would sup that night at Fontainebleau.

The first village on the road, Courtacon, was taken by assault. It was defended by French cyclists probably belonging to Conneau's cavalry corps.

Then, the village of Les Murets has to be taken; a battery is in position there. The whole regiment that tried to attack the village ran into a wire entanglement and had to retire. At eight o'clock in the morning, however, the French battery brought up its limbers, and the village was carried. Champcenest, further south, was also taken, but the movement stopped there. This point was to mark the extreme limit attained by the German cavalry in the campaign of France. The resistance became stronger and stronger. It was no longer made by rear-guards, merely trying to gain time, but by troops that had passed to the offensive.

Besides the order to stop had arrived; the main body of the cavalry went to Beton-Bazoches. The conquered villages were kept, however.

To the right, the movement of the Fourth Corps had also stopped. What had happened? Why had the decisive movement been suspended? It was because General von Kluck had received bad news. His Fourth Reserve Corps, already strongly attacked on the 5th, was obliged to yield quite a lot of ground, especially on its right wing, which was threatened with envelopment. It withdrew from Brégny to Vincy. The corps is backed up within 5 km. of the Ourcq, along the road from Meaux to La Ferte-Milon. General Maunoury has, besides, directed his Eighth Division south of Meaux, into the free space between the Fourth Reserve Corps and the English army. The situation is so clearly unfavorable that General von Kluck, without losing any time, orders the Second Corps to go to the help of the troops on the Ourcq. About 10 o'clock in the morning, the Second Corps broke off the combat with the English and marched to the two flanks of the Fourth Reserve Corps.

Under these conditions, the Fourth Active Corps had to give up its march on Provins. We have seen it stopped when its advance elements had reached the road from Melun to Provins. It turns about and goes north. The advance guard halted at La Ferté-sous-Jouarre, while the main body stayed south of the Marne, in the region around Rebais. The reason for this was probably that it was feared lest the English, profiting by circumstances, should hurl themselves vigorously into the gap.

The departure of the 80,000 men of the Second and Fourth German Corps left a gap of more than 40 km. between the Ourcq and the right wing of the Third Corps, at about Cerneux, west of Villers-Saint Georges. The Second Corps left only weak rear-guards on the Grand-Morin. To fill this dangerous gap, the German commander called on *his two cavalry corps*.

Von Marwitz's two divisions took position between Crécy and Coulommiers. They had before them the whole English army. That did not prevent them from holding until the morning of the 7th.

Von Richthofen's cavalry corps remained in its position at Beton-Bazoches, facing the cavalry of General Conneau and the left flank of the Eighteenth French Corps. In spite of the presence of the Fourth Active Corps south of the Marne, the situation is very risky for the German cavalry. To tell the truth, the Grand-Morin lends itself to a resistance of some length: it is especially embarrassing to the enemy's reconnaissance. But, the cavalry divisions were able to mask the movement to the rear and to hold in this exposed position less because of the position taken and the nature of the terrain than on account of the inaction of the English during the 6th of September. It seems that not before evening did Marshal French realize the

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departure of the Second and Fourth Corps and the consequent possibility of undertaking a fine enveloping maneuver.

The reasons for this delay in the service of exploration are not exactly known. Was the English cavalry corps in the right place, on the right wing? Was it lacking in initiative? Did its patrols function well? Were the aviators able to go up? Did Marshal French realize that the battle which had been going on on the Ourcq since the day before might well have its effect on that going on south of the Marne? Did he have as much perspiracity as General Foch, who tranquilly explained the increasingly violent attacks of the Germans by saying that "their affairs must be going badly elsewhere."

It may have been that the rear guards of the Second Corps and the German cavalry were able to stand them off; it may be that the English were passive. The fact remains that the advance-guards of the latter did not reach the road from Crécy to Coulommiers before evening. Reckoning the advance from the line of outposts, it averaged then 10 km. in the right wing and about 5 km. in the left wing. This does not appear very appropriate to the situation and the opportunity offered.

Von Richthofen's adversaries were more enterprising. However, the latter held the positions which he had had since noon and kept his gains of the morning, that is to say, the villages of Champcenest, les Murets and Courtacon.

General Franchet d'Espérey probably learned very tardily, more tardily still than Marshal French of the disappearance of the two German corps. He probably found out about it, on the morning of the 7th, from the reports of aviators. This fact, which has to do with reconnaissance and the maintenance of connection, will be interesting to elucidate later.

These circumstances enabled the Germans to accomplish in security their important and dangerous movement to the rear. The cavalry performed its mission well; it screened the movement and held back the adversary. The enemy's exploring parties could not get thru the fragile line kept intact and the adversary on that part of the front at least, could make no sensible progress.

During the 7th, the situation became more critical for the two German cavalry corps. The empty space behind them became greater. The Fourth Corps left the vicinity of Rebais, crossed the Marne and established itself in three groups east of the Ourcq, ready to intervene on that part of the battlefield. Under the pressure of Maunoury's army, which was reinforced by the Sixty-first Division coming by railroad to the vicinity of Nanteuil and which was put into action on the French left, the dislocating effect on the German line was accentuated. The Germans were stripping the sector south of the Marne of troops; the cavalry was left more and more to its own devices. Fortunately for it, the English still did not show much drive. Again it took them all day to make any advance of consequence.

General von Marwitz held the positions of Crécy and Coulommiers for a part of the day. He would probably have held them still longer if General von Richthofen, in retiring, had not uncovered his left, while his right was threatened by the advance of the Eighth French Division. The latter was progressing, indeed, south of Meaux, trying to pass between the rear-guards of the Second Corps and the cavalry. Under these conditions, General von Marwitz fell back from the Grand-Morin to the Petit-Morin. The numerous crossings were occupied and held until the following day.

The English army did not push very far ahead. Its cavalry, on the right wing, co-operated towards Jouy-sur-Morin with Conneau's cavalry. The First and Second Army Corps reached the road from La Ferté-Gaucher to Coulommiers in the evening. The Third Corps crossed the Grand-Morin and passed the night in the region north of Crécy.

As for von Richthofen's cavalry, it has had great difficulty in breaking off the combat in the morning. The chasseurs occupying Champcenest and Les Murets were violently attacked, while the cavalry had to repulse the French and English cavalry.

The left wing of the Eighteenth Corps also constituted a serious menace. The Germans might fear that, at any moment, the crossings of the Grand-Morin would be taken behind them. About 11 o'clock in the morning, General von Richthofen ordered a retreat to the Petit-Morin. The corps crossed at Tovy and La Ferté-Gaucher and went to take position in the sector La Sablonnière-Boitron. General von Marwitz soon came to establish himself on the right of von Richthofen.

In the evening, the four cavalry divisions are then drawn up on a front of 15 km. and are flanked by the rear-guards of the Second Corps to the right and those of the Fourth Corps on the left. The latter were about Hondevillers and Viels-Maisons. The French and English cavalry did not pursue beyond the Grand-Morin that day. They seem to have passed the night of the 7th-8th around La Ferté-Gaucher. On that day again the German cavalry fulfilled its mission completely. If the line did withdraw, it was not broken nor was the threatened envelopment accomplished.

The day of Sept 8th is contradictory in character. On the one hand, it is the time when the five days' battle attains its maximum intensity and, on the other, it seems that General von Kluck by withdrawing two new corps to the north of the Marne, without using them in their entirety on the Ourcq, must have already considered the game as lost.

The Sixty-second Division came and prolonged the left of the Sixth French Army. These troops were to act with General Sordet's three cavalry divisions to envelop the German right. Besides, the Fourth Corps, taken from Sarrail's army, was about to go into action with the Sixth Army.

And yet the situation of Maunoury was not good. The Fourth German active corps had crossed the Ourcq and entered the fight. Betz was retaken from the French, who in their turn were threatened with envelopment. General Joffre's plan seemed about to fail.

The decisive element of it, the maneuver on the Ourcq, was apparently compromised. Or at least, there was room for the French to fear so. Two other German corps, the Third and Ninth, had left the region south of the Marne and marched towards the Ourcq, supposedly to take part in the undecided battle. But they left only three regiments of infantry and two of artillery there, and continued their northward march. It has been stated that this was in order to prepare the more urgent works of the Aisne position. This fact, if it were confirmed, would prove that, from the 8th on, General von Kluck had no illusions about the situation. He saw it, perhaps, even more compromised than it really was, judging from the uneasiness reigning in Maunoury's army on that day.

Thus, the departure of the Third and Fourth Corps, on the morning of the 8th, left a new gap that had to be stopped. Again that task falls to the cavalry. Its line of defense is overextended: it goes from La Ferté-sous-Jouarre to Viels-Maisons. On its right, elements of the Second Corps try to stop the advance of the Eighth Division towards the road from Meaux to La Ferté-sous-Jouarre. On its left, a part of the Seventh Corps, which corps had not previously been engaged, went into action.

The Petit-Morin has rather steep banks, and the north bank commands the south bank. For these reasons it is relatively easy to defend, but there are numerous crossings. They all had to be held. The cavalry confronted the 120,000 men of the English army, which was marching from the Grand-Morin towards the line Viels-Maisons-La Ferté-sous-Jouarre. Von Marwitz's cavalry occupied the right sector.

Von Richthofen's staff was at Hondevillers, connected by telephone with the brigades and even with the regiments distributed at the crossings.

Each group possessed infantry and artillery. A regiment of uhlans and *schützen* companies of the Guard defended the Sablonnières bridge; the cuirassiers were at the Bellot bridge; the Fifth Cavalry Division, with a *jaeger* battalion of the Guard, defended the Orly sector on the right.

The combat was a violent one. The defenders tried to dig some trenches but there were not tools enough and the troops were unaccustomed to that kind of work. The protection was insufficient, and losses rapidly became more considerable. About the middle of the day, certain companies had only 40 or 50 men left.

The French cavalry appeared. The Germans wanted to charge it, but at this moment the shrapnel was falling thick and this attack had to be given up. Besides, the position was no longer tenable. Bellot bridge was taken by the French. Boitron was about to undergo the same fate. The combat was ordered broken off a little after noon. This was executed calmly, according to German accounts, but with further heavy losses.

Von Richthofen's corps retired to near Montfaucon, leaving strong rear-guards at the southern edges of the woods between La Chapelle and Viels-Maisons.

The cavalry of von Marwitz seems to have been a little less severely tried. It held in the evening and the night of the 8th-9th in the sector La Ferté-sous-Jouarre-Basseville.

In the evening, the Eighth French Division and the English army reached the high road from Meaux to Montmirail. The obstacle of the Petit-Morin was finally overcome; from then on, the way will be easier. But this gain was made slowly: it took all day to make it and to cover about 15 km. As on the two preceding days, the German cavalry succeeded in carrying out its mission: a hole between the First and Second Armies was not opened up. This skillful and energetic resistance was the more opportune because the neighboring infantry troops (Seventh and Ninth Corps) had lost Montmirail, captured by the Fifth French Army.

Along the whole front of Foch's army, the attacks had been extremely violent. Did the furious offensive of the Guard and Saxons constitute a last effort to break the French line, or rather was it an attempt to hold as many enemy troops as possible south of the Marne, in order to lighten the pressure on the Ourcq? Or, again, were they trying only to gain time, foreseeing the morrow's retreat? History will tell us, but the first supposition appears to be the true one. For, as we shall see, the attempts to break thru in this sector were renewed on the 9th with the same violence, at a time when the retreat had started on all the rest of the battlefield. (See later editorial note.—Ed.)

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The day of the 9th is of the same general character as the day before, only more pronounced. Positive retreat in the right wing, vehement attacks in the left wing.

The Fourth Corps from Sarrail's army has gone into action with Maunoury's army; besides, the Eighth Division, which we have seen operating south of Meaux, has become less necessary to the English and has been recalled. Transported by rail, it is put on the extreme left.

The front of the Sixth French Army extends from Nanteuil-le-Haudoin to near Vareddes. Betz is still in the hands of the Germans, but the crisis is over; the end is near.

The situation of the German army on the Ourcq is less and less favorable. The English, having still only the cavalry in front of them, are advancing now more rapidly, especially on their right. They execute a left wheel, with La Ferté-sous-Jouarre as the pivot. About noon, they reach the Marne and cross it, but they again run into von Marwitz's cavalry along the road from La Ferté-sous-Jouarre to Château-Thierry. This corps is now alone in the defense of this front. Von Richthofen's corps has marched in the direction of Dormans, objective assigned to the left flank of the Second Army, to which the cavalry belongs.

The two divisions of von Marwitz cannot naturally withstand very long the shock of the English army, especially as Conneau's cavalry corps and the advance guard of the Eighteenth French Corps are marching on Château-Thierry, threatening their flank.

It is at this moment, a little after noon, that General von Marwitz notifies General von Kluck that he cannot

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hold any longer. If the Germans wait any more, the army of the Ourcq will be taken in reverse by the English turning movement. General von Kluck then gives the order to retreat. [This does not agree with the version of Gustav Babin in "La Bataille de la Marne." He describes von Marwitz's last stand against the English as taking place about 4 p. m. (at Montreuil-aux-Lions on the road from Lizy to Château-Thierry). Some elements were retiring then from the vicinity of Lizy, but von Kluck did not issue the retreat order until 8 p. m. Hilaire Belloc goes so far as to say that Foch's piercing of the German Guard at La Fère-Champenoise was the turning-point of the battle and that it alone determined the withdrawal of von Kluck. It would be interesting to know why Belloc refers to von Marwitz as the "unfortunate and stupid von Marwitz"—he does not explain why.

According to Babin, Foch's smashing counter-offensive at La Fère-Champenoise and von Marwitz's unsuccessful attempt to stand off the English at Montreuil-aux-Lions, were practically synchronous. Each was decisive in its own sector.—Ed.]

The German left wing began the movement. The Meaux sector was emptied of troops, while, on the right wing, near Bargny, a counter-offensive gained time. Little by little, the German corps slip off towards Soissons, leaving strong rear-guards which held long enough. The next day, they stopped Sordet's cavalry in its attempted pursuit at the edges of the forest of Villers-Coterets.

After its retreat, von Marwitz's corps passed the night in the region of Courchamp, northwest of Château-Thierry. Von Richthofen"s cavalry does not appear to have offered as much resistance as von Marwitz's cavalry. In the morning of the 9th it was still in its position at Montfaucon-Essises. Trenches had been dug, but soon, due to the progress of the Eighteenth French Corps, it had to beat a retreat, for it ran great risk of being cut off from its Second Army. Already, French forces were attacking from Montmirail in the direction of Condé. The cavalry was drawn along in the general retreat movement; it marched towards the Marne, crossed that river at Dormans and remained during the night in the vicinity of Vincelles. A squadron of cuirassiers was sent out from there for the purpose of finding out in what force the French had already gained the north bank of the Marne at Château-Thierry. This squadron did not come back. It took two days to reach Mont-Saint-Père, could not go any further and was finally captured as a unit.

On the German right, the battle was practically over a little after noon. On the rest of the front it was prolonged. To be sure, von Bülow's army was not able to hold very long. On one side the violent attacks of the Fifth French Army, on the other the advance of the Eighteenth Corps towards Château-Thierry, forced it to evacuate its line of defense north of the road from Montmirail to Champaubert.

It is in front of Foch's army that the battle rages longest. As on the day before, the Guard and the Saxons renew their desperate attacks. The Guard even gains some ground near Mondement; the Saxons push as far as Salon, but it is the swan song. On their right, the field of battle is entirely evacuated by German troops. A great deal has already been risked by waiting so long: the Tenth French Corps is on their right flank—it would be sufficient to push by the heights of Courjeonnet and Congy to provoke a disaster. Towards evening, the Germans break off the combat. On Sept 10, all the German army east and west of Vitry-le-François was in full retreat towards the Marne.

(To be continued)

[Cavalry Study. (Continuation.) By Lt.-Col. H. Poudret. *Rev. Mil. Suisse*, Apr, '17. 4000 words.]

General von Kluck, as has been seen, used his numerous cavalry to excellent advantage. He certainly has the greatest confidence in their fighting power, since he gave them the task of masking his movements, of holding the enemy long enough, of preventing the latter from throwing himself into the great interval which began to be created on the morning of the 6th, and of preventing, in exceedingly difficult circumstances, an enveloping movement very tempting to the adversary.

The importance of the role of the German cavalry in the battle of the Marne stands out the more if one realizes that the definite order to retreat was not given until General von Marwitz stated that he could not hold any longer. The limit of the cavalry resistance constituted the decisive factor.

(*Note.*—After the battle of the Marne the two cavalry corps must have been united again under the command of General von Marwitz. They participated in the struggle for envelopment which characterized the period following the battle of the Marne.)

This race to the sea was more than a war of movement, it was a war of speed, and the cavalry naturally took part in it. It went northward, reaching successively and not without daily fights, the vicinity of Péronne, Bapaume and Arras. This is an interesting period of its work in reconnaissance, which was not such an easy task as in August. From Oct 5-10, the cavalry was in the neighborhood of Lens, fighting incessantly. Then, moving still further north, it met on the Lys an adversary worthy of it, sometimes even superior to it,—the French cavalry supported by the "fusiliers marins." The sector Bailleul-Estaires-Hazebrouck was the theater of numerous actions, not so much in the nature of combats of large units as in that of minor engagements. In November, after a week's rest, a part of the German cavalry was called to the seashore at Nieuport, but not for long. At the beginning of December it was transported to the Eastern front. There it found plenty of room and a still larger field of activities. A special study would be needed to relate the numerous operations in which it took part from the spring of 1915 on. Among its finest feats of arms those accomplished by it at the time of the operations against Vilna are worthy of note. The Germans owed to it their success, in a large measure. After the fall of Kowno, large bodies of German cavalry acted against the railroads and

communications of the 10th Russian Army. It cut off the retreat of the latter several times, and came very near causing its surrender.

The cavalry's task in the battle of the Marne seems to have been made possible by two circumstances. First, the English army's lack of "punch," the time that it took to realize the favorable opportunity offered to it, its slowness in reaching first the Petit-Morin, then the Marne. Not that we must fall into the exaggeration of certain German authors who claim that the English took two days and a half to cover, *without having fired a single cannon shot,* the 20 km. separating the Grand-Morin from the Marne. But it may be stated that against an adversary more used to war of movement and less exhausted by the trying retreat of the preceding days, the German cavalry would not have gotten along so well.

In the second place it must not be forgotten that the cavalry corps of von Marwitz and Richthofen constituted a large force, capable of operating independently over a large front. With 12,000 troopers, 6 to 8 battalions of infantry and 72 guns, not to speak of the numerous machine guns and cyclists, one may undertake something, especially if the terrain is favorable. To judge of the activity and accomplishments of the German cavalry, one should not lose sight of these figures and should be careful not to make comparisons with what might be demanded from our small brigade.

As to the execution of the mission, it must have already been noticed that it was only by dismounted combat that the cavalry achieved the result. It is quite evident that it could not have fulfilled its task for four days by mounted attacks. It makes little difference anyway: it is immaterial whether the mission assigned be accomplished by this means or that,—the main thing is that it be accomplished.

It might be believed that infantry alone could have done the same. Perhaps this is true, but (the author) is not convinced of it. For occupying a large sector, *to be on hand* at the different points, for deceiving the adversary as to its strength, for occupying or abandoning a point according to circumstances, for disappearing with rapidity and reappearing unexpectedly, no arm is as good as the cavalry. In the circumstances that we have studied, the infantry would not have been of more service than the cavalry; it is probable that it could not have done so much, for it would have lacked mobility.

It would not have been able, as the cavalry did, to reinforce rapidly a threatened point by means of elements borrowed from another, where, contrary to expectations, the pressure was less strong.

The use General von Kluck made of his cavalry constitutes an extremely interesting study in the tactical use of that arm. It is believed that never before had such a rôle devolved upon the cavalry. Not that the principle was entirely new. Our regulations have foreseen it in the article which lays down, among other tasks incumbent on the independent cavalry, that which consists in "seizing or guarding points or sectors having strategic or tactical importance." But what was hardly to be supposed was a task of such scope and duration. This example will certainly not pass unnoticed. It may even be foreseen that in the future one of the most important missions devolving on the cavalry, on its large units, of course, will be to go with speed *"to stop a gap"* produced on the battlefield.

The procedure will be the same as at the Marne. It is with its rifles, its machine guns, its guns, if it has any, that the cavalry will defend the advanced sectors spoken of by our regulations or will stop the gaps; in "other words, by dismounted action." It is believed that, no matter how it affects us, the moment has come when the last illusions as to the efficacy of the charge *in large units except in the case of pursuit,* must disappear.

Certainly there is no cavalryman who will come to this conclusion without regret. There is not one, if he is realy a cavalryman, who will not ask himself each time before dismounting if really a mounted attack might not be executed. But there must be a reason for doing so. And then there is one consolation: mounted attacks by small units, easy to mask, more mobile, less vulnerable, may and ought to be attempted. When the history of this war is known in detail, it will be surprising to see how numerous feats of arms of this kind have been. While seeing things as they are, we must be careful not to generalize too much.

(*Note.*—We should be especially careful not to take away from isolated troopers, dispatch bearers, patrols, platoons of the advance guard, their confidence in mounted combat against horsemen or even against foot soldiers whom they meet unexpectedly and who try to bar their road. There the least hesitation is fatal. The patrol that gets its sabers out first is the one that is master of the terrain and that gets thru. Misfortune to those who hesitate and who try to dismount at the last moment to use their firearms. Numerous examples in the present war confirm this fact.)

Indeed, will what is called rather vaguely the "cavalry spirit" suffer so very much from this adjustment to modern combat? It is thought not, and paradoxical as it may seem, the more cavalry fights on foot, the better it will have to be mounted and the better it will have to know how to ride. Much better horses and much better riders are needed to be able, without stopping and at speed, to cross any zone whatever. any obstacle with a view to occupying a position, than for the charge on level ground. The finest mounted attacks of history, those of the First Empire, were executed so to speak, at a trot; the gallop was taken only at the last moment. The cuirassiers had such heavy horses that they could not be used for reconnaisance. Comparing them with the light cavalrymen and the blooded horses of to-day, it cannot really be claimed that the situation is less favorable now than in the past with respect to the element mobility,—speed. Besides, what makes the cavalry spirit is a taste for risk, for the offensive, for prompt decision, for bold execution; all these qualities can and should be found in the maneuver for dismounted combat.

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Let us make our decision then. Let us drill in both kinds of combat, but let us improve more and more in the one that is the newest for us and thanks to which we shall be of the most service. *Let us learn to cover great distances* in order to forstall the enemy and arrive before he does at the point we want to occupy with our rifles and machine guns, in order to be able to surprise him, to attack him, and to harry his flanks. Let us continue the serious work begun on rifle practice. Let us make a real shot out of each of our dragoons. Let us be able to use our machine guns in little groups, without thinking too much about protecting them. If we are willing to risk them, there are many important tasks we can fulfill with them in a terrain like ours.

But for such use the cavalry must be strong. *A cavalry too small in numbers is of no use.* It will never be able, under these conditions, to execute an independent mission. Each mission assigned us by our regulations requires a certain power. Weak cavalry cannot reconnoiter well. If its patrol reservoir is soon exhausted, and if its main body cannot be maintained in the sector which interests it, no reconnaissance can go forward.

To occupy and guard a sector, there must be a sufficient number of rifles and machine guns. To stop a gap the same thing holds. In a word, if one wants to be able to count on his cavalry he must be careful not to weaken it as certain people would like to do under pretext "that it is of no use." Either strong cavalry or no independent cavalry. There is no middle term. Thus, let not a horse nor a machine gun be taken away from our brigades, but rather let the strength of our squadron be increased, if possible.

We have the great disadvantage of having no horse artillery. This arm could co-operate in the most useful way with the cavalry, even in our terrain.

The use of cavalry in large units, *operating alone,* without any help from infantry, appears to be becoming rarer. The future is for the *mixed detachment.* The Germans were very careful, on the Western front at least, not to let their cavalry act as *cavalier seul.* The co-operation of the chasseur battalions and artillery had a good deal to do with their success. Never without these auxiliaries would it have succeeded in its task and it is a striking thing that the infantry, far from retarding its march, rather accelerated it by the fact that the obstacles met on the road were more easily surmounted. The marches, tho shorter, were more regular.

The query arises here as to whether the German cavalry did not abuse its chasseur battalions. We get the impression, sometimes, that it saved itself at their expense. It appears certain that the infantry often left two to three hours before the cavalry to "clear the road." This way of doing is certainly practical, but cannot serve us as an example. The infantry should be used rather as a support, holding crossings behind the cavalry, keeping the doors open, or else, serving as pivot for the maneuver, or for frontal attack; while the cavalry, utilizing its mobility, acts on the flanks. The infantry should march, not in front of the cavalry, but behind it or abreast of it, according to circumstances.

The conduct of the combined detachment cannot be improvised. Our cavalry instruction should be based more on its study than on that of the arm working alone.

(*Note.*—The Germans have carried very far the system of the mixed detachment. They use it for combat and for reconnaissance service, and also, as may seem strange at first sight, for their destruction patrols. This was particularly the case on the Russian front.

In September, 1915, a patrol received an order to destroy the railroad Molodeczno-Poloczk. It was made up of two squadrons, a cyclist company, four machine guns, *a piece of artillery* and a pioneer detachment. According to the Germans, it succeeded in its mission despite the opposition of a Russian battalion.)

As for *exploration,* we learn nothing very new from a study of the first two months of the war on the Western front. Our excellent regulations on that subject, it would seem, can be kept in their entirety. All the cases foreseen, all the rules laid down, are up to date, even tho the regulations are twenty years old.

The question of whether exploration should be done only by platoons or squadrons does not seem to be settled. In some cases small patrols have been able to fulfill their mission; in others whole platoons or squadrons have been necessary and sometimes have not been sufficient. Here again we must not generalize. Circumstances will decide which of the two systems will have to be used. One thing is, however, certain. In order that an exploration squadron should have some chance of rejoining its main body fairly rapidly, a heliographic outfit should accompany the detachment. The position of the main body can be signalled to the detached squadron.

The assignment of cyclists to exploration squadrons on the Western front and in the good season appears to have given good results. This was favored by the fine roads of France. Airplanes do not seem to have diminished sensibly the activity of exploration by the cavalry. They will never be able to make detailed reconnaissances; it is the same when the weather is foggy and the country wooded. On the other hand, the exploration of the battlefield will belong to the airplanes exclusively, or nearly so.

In what concerns formations it is difficult to say now what changes the war will bring. Modifications will probably have to do with echeloning of columns, marching in deployed lines, moving of squadrons in checkerboard formation. (See the excellent pamphlet of Lieut-Col. Carrère: *Cavalerie Son emploi dans la guerre moderne.* Lavauzelle, Paris, 1916.) Any compact formation will have to be condemned. On the march, the squadrons, the platoons even, will have to be echeloned: ranks will have to be opened, perhaps and to move far apart. Deployed lines will have to be developed and columns avoided, in a general way. This will not facilitate maneuvering and will not increase mobility.

But, above everything, it will be important to develop a sense of the terrain, even in the last trooper. He will have to be taught still better than he is now, the value of cover. Maneuvers have spoiled us in this respect, and we should profit by the experience of others.

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In ending this paper it is desired to repeat what was said at the beginning. If particular attention has been paid to the German cavalry, it is because more information was available about it. When it can be done it will be profitable to study the Belgian cavalry, which presents the greatest interest for us, on account of its smaller effective strength and the nature of its task. Then we shall have to follow the French cavalry in its numerous operations, the work of the 7th and 10th divisions in the region of Virton and Arlop, in front of the III and IV Corps, as well as that of the units which operated towards Neufchateau and Bouillon. Sordet's raid into Belgium, and the very important use of the two cavalry corps (I and II) at the time of the British retreat, the rôle of Sordet's corps on the Ourcq, that of Conneau's corps at the battle of the Charmes gap and towards Provins, that of Mitry's corps at the Camp de Mailly, finally the numerous actions of the French cavalry in the period of the "race to the sea."

On the Western front again, the study of the English cavalry is not to be neglected. Its action during the retreat of its army, especially at Valenciennes on Aug 24, at Cambrai on the 26th, then at the Marne and later still, at the Mort des Cats merits more than a simple mention. It has to its credit, besides, the large and glorious share it took in the battle of Ypres (17th Oct-6th Nov) during which it maintained itself more than ten days in the villages of Messines and Wytschaete, in most difficult circumstances.

Such research will be most instructive for officers of the army. It will probably succeed in convincing others of the utility of the cavalry.

(*Note.*—One should not allow himself to be hypnotized by trench warfare. War of movement alone can bring the decision. Besides, there will not always be wars of attrition and it would be false to consider that form of combat as that of the future. If trench warfare has taken on in the present conflict, such extended application, this results much more from the fact that the Germans have had to fight on two fronts than from progress in armament and modern technique.

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The effort has been made to demonstrate the utility of the cavalry here. Following is the opinion of one whose authority and competence will not be contested by anyone, no less a person than General Bonnal. This is what he writes in his book, *Les Conditions de la Guerre Moderne:*

"Limiting one's self to an examination of the operations of the cavalry corps at the beginning of the present war, as well in the German army as in the French army, one concludes that these large cavalry units gave important services to the armies which it was their mission to enlighten and protect."

This opinion is the best answer to those who talk of the "failure of the cavalry."

[A Study of Cavalry. By Lt.-Col. Poudret. (*Revue Militaire Suisse*) *Memorial de Caballería,* May, '17. 5200 words. 3 sketches.]

(An account of the operations of the German Cavalry in Belgium and France during August and September, 1914.)

It is stated that Belgian reconnoitering groups were unable to penetrate the German cavalry screen. The work of the German cavalry at this time was not especially difficult, but it must be admitted that it was well executed. The cavalry opened the way for the infantry and fixed its talons in the flanks of the retreating enemy. Contact was never lost. The crossings of the Aisne, the Oise, the Marne, of the Petit and Grand Morin were invariably occupied in time, thanks to the activity of advance guards and often to the audacious attacks of the cavalry point. Reconnaissance, in so far as it pertained to the cavalry, was always well performed. It is to be noted that in this prolonged pursuit not one important detachment was surprised or cut off. This was probably due to the following causes: Bivouacs were from 30 to 40 kilometers apart. This does not indicate a rapid rate of progress but daily engagements, the desire of the cavalry commander to keep his force in hand, the numerous water courses to cross, and the many reconnaissances effected, all combined to reduce the distance to the front that was covered daily. The methods employed were such that the German cavalry was always in good condition to take part in battle. The horses were tired but never exhausted; the morale of the men was always high. There were many saddle sores, which in view of the lack of rest, is not surprising. The large horses of the cuirassiers suffered more than the smaller animals of the hussars, which once more proves the greater resisting powers of smaller horses.

Losses in personnel were small. The Germans attribute this to the extremely poor marksmanship of their adversaries. Fire direction was usually very poor. The artillery was generally used to drive out the enemy whenever positions were held in sufficient force to cause appreciable losses to the pursuers. In combats for the possession of localities battalions of casadores were thrown to the front, dismounted squadrons placed on the wings, and mounted groups on the flanks, in readiness to execute enveloping movements and so cut off the retreat of the enemy. This maneuver, which was frequently repeated, resulted in the capture of a great number of prisoners. Advance guards generally had with them machine guns and

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cyclist detachments. Groups of the latter frequently accompanied patrols. French and Belgian accounts mention the presence with the cavalry of German infantry transported in auto trucks. The German accounts made no reference to this use of infantry.

(To be continued.)

[With the Cavalry on the Western Front. The Storming of Monchy. *Sphere,* May 26, '17. 1800 words. Map.]

Monchy was captured after three days of heavy fighting. The Prussians had been ordered to hold the village at all costs, but the reserves from the rest billets in Douai and Cambria could not arrive in time.

British cavalry took part in the final attack riding down nests of snipers and pockets of machine gunners thru a storm of shrapnel and shell, and charged into the northern end of Monchy. Then came the German bombardment as soon as the German gunners were sure that the British were in occupation.

The cavalry dismounted and worked their way down the eastern slope until they were able to command the shallow trench at the bottom with their Lewis and Hotchkiss guns. The counter attack of the Germans was not able to advance more than 100 yards before they were driven back by fire.

[Study of Cavalry. By Lt.-Col. Poudret. *Memorial de Caballería,* June, '17. 2000 words.]

(A condensed account of the operations of the German cavalry at the battle of the Marne.)

(To be continued.)

[Cavalry in the Great War. By Captain Henry J. Reilly, 1st Ill. F. A. *Jour. U. S. Cavalry Assn.* Apr, '17. 2250 words.]

(The *Cavalry Journal* deems itself fortunate in receiving this article written especially and exclusively for it by a military expert and trained writer. Capt. Reilly was formerly in the U. S. Army and has been a war correspondent in France. Three important facts stand out in the article: (1) When the time for its use comes, cavalry must be used in great masses; (2) It must be exceedingly mobile; and (3) It must be as efficient in fire effect as any opposing foot troops.)

Altho information is lacking as to minor details, enough is known to show that the European conception of the use of cavalry was wrong. The arms and organization showed no intention of seriously engaging infantry. Fighting on foot was taught rather as a precaution than as a serious method of combat.

The training of the larger units was for reconnaissance and for fighting cavalry, with the hope for a chance at routed infantry.

In the open fighting, the cavalry has done its work of reconnaissance and fighting enemy cavalry, but has not exercised a decisive influence. Has the day of cavalry passed, or did it not take advantage of its opportunities?

The largest conceptions are simplest, but the details may be voluminous and complicated. This war has shown that the first conception of the use of any arm must be in broad, simple terms, and the corresponding details of organization, training, etc., then worked out.

Flying was in its infancy at the beginning of the war, but the valuable work done made it necessary to provide machines and aviators by the thousands, whatever the difficulties involved. The results in reconnaissance and in the direction of artillery fire have shown that such provision was justified.

The French conception of the use of the 75 mm. gun to produce a storm of shells and thus blow a hole for penetration of the enemy infantry was a distinct advance in this arm. The Germans developed the heavy field guns and were thus able to overcome the existing fortifications. But the present use of heavy guns to deprive the infantry of cover and light guns to cut it off from escape or help is a still greater advance, and the necessary supply of ammunition, enormous and difficult to obtain, must nevertheless be found.

In the beginning of the war the German infantry made tremendous marches, but they were unable to bring the Allies to bay or to outflank them. Nor could the Allies move fast enough after the Marne to prevent the Germans settling themselves on the Aisne. The Germans drove the Russians back from the Dunajec in 1915, and thence practically out of Galicia. Altho in these great movements enormous captures of prisoners and guns were made, none of them have been decisive victories. The reason is that infantry cannot outmarch equal infantry. Cavalry can outmarch infantry, but unless it can fight on equal terms and be equal in numbers, it can do no harm by outmarching infantry. This was the case in Europe and so the cavalry could not take advantage of the opportunities.

Infantry in motor trucks will not answer the requirements. Trucks must keep to the roads and shun artillery fire. Hence at a critical time, infantry in motor trucks loses its mobility. Cavalry can move rapidly over almost any kind of ground and can get thru the extreme zones of artillery with less loss than equal numbers of infantry. Another reason against infantry in motor trucks is that the roads are already fully utilized by the transportation of a modern army. The mobility of cavalry can be utilized fully with motor transportation.

This war has brought no change in underlying principles. It has merely changed the methods of following the principles. Aviation must furnish the information before, during, and after the combat. Artillery must prepare the attack, and the infantry must drive the enemy out of his position. The finishing blow must be delivered by a force sufficiently mobile to outmarch him, and the present war seems to prove that this can be done by a large, strongly armed, determined cavalry, animated by a desire to attain the result regardless of loss, in the same manner that the infantry makes its decisive assaults. All that

is needed is a broad conception of the use of cavalry, unhampered by the numerous details made necessary by modern military conditions.

[Cavalry Tactics on the Western Line. *Jour. U. S. Cavalry Assn.*, Apr, '17. 2800 words.]

(From official orders published by the commander of an Allied cavalry division in France. Authentic, but the writer does not disclose the source of his information.)

Before cavalry is employed, the enemy first line must be broken on a considerable front, probably in several places. Then the cavalry operations must be governed by a carefully prepared plan and suitable orders.

There are numerous points prepared for defense behind the first line system, but sufficient reserves will hardly be available to resist pressure at every point. In such conditions the cavalry would be employed in large bodies to push thru and seize important points, harass the enemy and prevent reorganization. Necessary provision for suitable transportation (wheel or pack as required) must be made.

If the infantry action promises an opportunity for the use of cavalry, all necessary information as to routes of approach must be secured and arrangements made for crossing the trench system on as broad a front as possible. If crossed of necessity on a narrow front, extension will be made when the obstacles are passed. Precise orders must govern this stage of the advance. The idea is to get clear of the other troops. The advance to successive objectives will then begin. The formation should be successive lines of troop columns when possible. Advance in large masses should be avoided. A general alignment only is necessary. All hostile wires should be destroyed. Barrage fire would be ineffective against rapidly moving cavalry.

In trench warfare, the guns are dug in and without escort. The cavalry should seek to put the hostile batteries out of action. Villages and other defended points must be masked and the forward movement continued.

The supply of ammunition is a serious problem in such a movement, and unnecessary expenditure must be avoided. The force must not be frittered away in detachments to guard prisoners or guns. Prisoners must be disarmed and guns destroyed or disabled. The advance must be by bounds with pauses as short as possible. The brigadiers must be close up so as to impart the necessary drive. All advances must be made mounted as long as possible and mounted action used. Dismounted action must be put off as long as possible, because mobility is thus lost.

Reckless pursuit and action must be avoided or costly checks will result. Everybody down to subalterns must understand the object, and communication laterally and to the rear must be continuous.

The business of the cavalry will be to attain a designated objective and hold on until the infantry can reorganize and come up. No uncontrolled pursuit must be allowed, but everything must be carefully co-ordinated.

In carrying out such an operation, no price can be too high if success is achieved, and no half measures will succeed. There must be a determination to drive forward undeterred by losses or fatigue.

—Use of in Russo-Turkish War

[Calvary in War. By P. Bashinov. *Voenny Sbornik*, Dec, '16. 5000 words and one map.]

(This article is a detailed account of the work of the Russian cavalry in the Russo-Turkish War of 1877-1878, and is a continuation from preceding articles.

The account is very detailed, and is in part supported by suitable references to quoted documents; but discussions are omitted. The present part of this series of articles refers to the operations of the Caucasus Cavalry Brigade, while in front of Lovtcha, during the autumn of 1877, and the movements and actions of single squadrons are all carefully recorded.

Nothing of special interest is brought out in this recital of events It is of historical interest, but not otherwise of value. The operations themselves relate to such a small part of the forces engaged in this campaign that they could hardly be followed by anyone not intimately acquainted with this war.)

[The Russian Cavalry in the War of 1877-1878. By P. Bashinov, *Voenny Sbornik*, Jan, '17. 4800 words. (Continued from preceding number.)]

[This article is an account of the work of the Russian cavalry about Plevna. Altho a note to the title of the article claims that it is intended as a critical account of the actions of the cavalry, no criticisms are given, the account being merely a very detailed one. A considerable number of references are given by the author for statements made by him, and his narrative gives signs that a good deal of labor has been spent to secure an accurate record of the movements of all Russian cavalry in the period treated of.

The article would, however, have been of much more value, had it been accompanied by suitable maps, and descriptions of the terrain, together with criticisms of what the cavalry might and should have done, in addition to a bare recital as to what it did do. As it stands the article is of little interest to American readers, not engaged in research work on the Russo-Turkish war of 1877-1878; for the latter it would probably be a good reference work.]

[The Cavalry in War. By P. Vashenov. *Voenny Sbornik*, Feb, '17. 500 words.]

(This article is a detailed account of the work of the Russian cavalry in the Russo-Turkish war, from the beginning of operations around Plevna to the arrival of the Guard division and other reinforcements; or from about Aug 1 to about Sept 5, 1877.

Altho the article claims to be a critical study of the operations treated of it is not in fact so, but is a detailed study. Nothing of special interest to American readers is brought out. The operations themselves are

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fairly well known in this country, and the names of the officers mentioned in the article, or the names of the particular organizations engaged in the various events of the campaign would convey little to us.

As regards the historical value of the account, the author does not state the sources of his information, and without knowing this it is impossible without much labor to determine whether his accounts will bear careful analysis.)

[Cavalry in War (1877-1878). By P. Bashinov. *Voenny Sbornik,* Mar, '17. 5000 words.]

(This article is a continued one, giving a detailed account of the actions of the Russian cavalry during the Russo-Turkish war. The present installment covers the period Sept 7th to Sept 13th, 1877.

A general survey of the positions of the Russian forces on Sept 7th is first given. Then follows a discussion of the necessity for further information concerning the enemy, and an account of a reconnaissance that was made. The movements, and in most cases the orders, of each body of the cavalry are next recited in detail for the period treated of.

As pointed out in a prior review, criticisms of the actions of the cavalry are not made, nor are the authorities quoted for the various statements made. The article, altho apparently exhaustive, contains little of interest to American readers.)

CENSORSHIP (of the Press)

See
PRESS CENSORSHIP

CHAPLAINS

[The Activity of the Chaplain in the German Army. From German correspondence. *Schweiz. Monatschrift aller Waffen,* Sept, '17. 2000 words.]

The world war has demonstrated the truth of the old observation that not the numbers, but the skill and the morale of the troops, produce victories. As religion has always exercised a profound influence on morale, the German government has always taken a lively interest in stimulation of religion among the soldiers, and from the beginning of the war has taken care to have preachers of the various sects accompany the troops and conduct field services. The furtherance of this work being to the interest of the churches also, the latter sent numbers of their preachers to the front. At first each division had an Evangelical and a Catholic chaplain; later this number was doubled; then hospital chaplains were added. At present there are about 800 Evangelical, 800 Catholic, and 25 Jewish chaplains.

The foremost activity of the chaplains is preaching. Services are held whenever possible. The circumstances of stress and danger have awakened religious interest in thousands in whom it had become dormant. The services are crowded. When possible, churches are utilized; otherwise barns are turned into churches, or altars are erected in the fields. Sometimes as many as six services are conducted on a single Sunday by the same chaplain to accommodate all his hearers. Services are also conducted in the dugouts in the front line trenches.

The development of the war of position afforded opportunity to the chaplains for another activity, that of providing amusement for the soldiers. Club rooms, reading rooms, company libraries, stereopticon shows, and concerts were instituted. The reading and club rooms were established all along the line immediately behind the front lines.

Another important activity of the chaplains is furnishing spiritual comfort to the wounded and dying. In addition it is frequently the chaplain who sends home the first news of the wounds of a son or the last words of the dying husband. Similarly the chaplains also send to hostile countries the last greetings of the dying prisoners. They also officiate at burials, which, when possible, take place in the newly established cemeteries at the front, which are among the most beautiful in the world.

At the front Evangelical and Catholic chaplains cooperate in amity. The adherents of the different creeds cannot always be accommodated with chaplains of their own sect, but Protestants have learned to receive spiritual consolation from Catholic chaplains, and vice versa. There has been a general revival of religion among the troops.

CHARMES GAP, Battle of

[The Battle of Charmes Gap (la Trouée de Charmes). By Gabriel Hanotaux, of the French Academy. *Revue des Deux Mondes,* Nov 15, '16. 21,500 words. Two maps.]

The general plan of the German attack on the French frontier was an application of the principles of Schlieffen—an immense drive by the German armies against the French frontier, describing, from the North Sea to the Vosges, a huge semi-circle intended to hem in the French armies from the East and the West, while the center advanced to deal the decisive blow.

Von Kluck was in command of the right wing; he was to cross the Sambre, the Oise and the Aisne, leave Paris to one side, and extend one branch of the tongs toward Troyes. The Crown Prince of Bavaria commanded the left wing; he was to cross the frontier, leave Nancy to one side, and force the Charmes Gap, in order to extend the other branch of the pincers toward Neufchatel and Troyes. The German Crown Prince was to come down from Luxemburg, avoiding Verdun, and to advance upon Bar-le Duc and Troyes. The point of rendezvous selected was, therefore, approximately on the Seine. The objective of the Prince of Bavaria was shown by a captured copy of an order to be Rozelieures, i. e., the Charmes Gap.

The objective of the cavalry of the German Crown Prince was revealed by an order of Sept 6, to be Dijon. The ensemble of the plan shows that it was intended that the armies of the two princes should play the principal rôles at the windup, and should therefore gather the most laurels.

The battle of the Ourcq and the victory on the Marne are well known as having interfered with this plan, but little is known of the important battle in the East, which culminated in the Battle of Charmes Gap.

One German army, under Prince Rupprecht of Bavaria, debouching via Metz (from Lorraine), the other, under General Von Heeringen, via Strasbourg (from Alsace), marched upon the gap. If they got thru, our eastern strongholds would be turned, and General Joffre's army taken in reverse.

The 1st and second French armies had taken the offensive Aug 14th. Combining their movement with that of the army which entered Alsace, they advanced into Lorraine. The first of these two, under General Dubail, had occupied Sarrebourg, and advanced on Fenestrange; the second, under General de Castelnau, debouching from Château-Salins, had advanced upon Morhange and Vergaville, to cut the Metz-Strasbourg railroad at Bensdorf. But both armies found extremely strong preparations in front of them. After some heavy fighting, both had to fall back to French soil, and the German armies, believing themselves masters of the situation, got under way, in their turn, to begin the execution of the great movement upon Charmes Gap.

They met strong resistance, suffered losses and fatigue in their turn. Their advance became hesitating. They attempted no pursuit, no cavalry raid, no crushing blow. The French, withdrawing by order, and the Germans advancing by order, awaited a propitious moment to engage anew in a supreme struggle.

The theater of these occurrences is included in the triangle whose base is the frontier between Mount Donon and the "Signal de Xon," in front of Mousson, and whose apex is at the village of Rozelieures, at the entrance of the Charmes Gap. The median point of this triangle is approximately Lunéville. From Lunéville the roads from Lorraine and Alsace lead to Charmes Gap.

On the 20th and 21st of August General Dubail's army was obliged to abandon Mount Donon and fall back toward the Meurthe and the Mortagne. General de Castelnau's army had been forced back from the frontier. It fell back, forming a semi-circle to the right so as to occupy the heights of the Grand Couronné which defends Nancy.

The danger of this disposition lay in the fact that by this double movement the two armies had become separated; there was a break between them, and this break existed precisely in the region of Lunéville, opposite Charmes Gap. This offered a great temptation to the enemy to hasten thru the door left open before him, and gain his objective, the famous gap.

But the French commanders grasped the situation, and did what was needed to parry the blow. They planned the two days' operations which were to result in trapping the enemy.

The maneuver planned was naturally evolved from the character of the terrain. Dubail's army was to resist on the successive river lines, on the Vezonse, the Meurthe, the Mortagne, in order to bar the road to the German armies, whereas General de Castelnau was to take up and organize a position on the Grand Couronné with a view to defending Nancy or to maneuver against the enemy if the latter should march directly upon the gap.

The natural defences of Nancy resemble the two shells of an almond. The east shell is the Grand Couronné, the west shell is the forest de Haye; they are separated by the Moselle.

From the Mousson bridge a wooded plain extends to the front east of the Moselle. Then the ground rises rapidly, and drops, dominating the valley. The hill Sainte Geneviève is the first of the series forming the Grand Couronné. The landscape is impressive. Near Nancy is the rocky hill of Mousson; in the distance the Signal de Xon (above the Mousson bridge at Pont-à-Mousson); at the foot of the Signal de Xon the Moselle runs to the left. On the other bank, Pont-à-Mousson, and beyond, more to the west, beneath the haze, the slopes of Bois-le-Prêtre. On the horizon, in a higher and still hazier atmosphere, can be seen the spires and chimneys of Metz.

Between Metz and Nancy the forests rise and fall, forming a moving, treacherous curtain that veils the region uniting the two cities.

South of Mount Sainte Geneviève, the Grand Couronné reveals its rough, coppled face. It is nothing but heights and small valleys, slopes and counter-slopes, summits that command one another, ravines that wrinkle the plain, and bury themselves in the hollows of the woods. From north to south, are Mount Toulon (375 meters high), Mount St. Jean (407 meters), the Moivrous (411 meters), the Grand Mont d'Amance (410 meters), and across the gorge made by the Pisotte flowing toward Dommartin, Lay, and Nancy, is the Rembétant above Varongéville and Dombasle. Resting on the Sânon and the canal from the Marne to the Rhine, it forms a hog-back dominating the plain to the south toward Lunéville as Sainte Geneviève dominates it to the north toward Metz.

The forests have always played a tremendous part in the defense of the roads thru Lorraine. They are like flank guards. They have been of value in the situation now under discussion. The Grand Couronné region was the home, so to speak, of the 20th corps. Almost all the generals with the second army had been in command of that district.

The evening of the 21st, General de Castelnau placed the fortified front of Nancy under the orders of General Léon Durand, dividing the front into four sectors:

1. *The Rembétant:* A mixed brigade of the 9th Corps, two regiments of reserve and a group of artillery from the 9th Corps. (Col. Briant.)
2. *Seichamps-Pulnoy:* 34th Brigade, a group and two batteries of artillery, and one squadron of the 7th Hussars. (General Guignabaudet.)
3. *Mont d' Amance-La Rochette:* 70th Division of the Reserves. (Gen. Fayalle, the future commander of the 6th Army of the Somme, in the battle of July, 1916.)

CHARMES GAP, Battle of—Continued

4. *Jaudelaincourt-Mont Sainte Geneviève:* 59th Reserve Division and the 35th Mixed Brigade. (Gen. Ropp.)

In addition, the post at Toul was placed under the direct orders of General de Castelnau.

The night of the 21-22 passed without incident. The 2d army was reforming and catching its breath behind the shelter of the trenches prepared on the Grand Couronné; the cavalry covered the right of the 2d army and assured its connection with the 1st army.

On the 22d, the front north and east of the Couronné was intermittently bombarded; our artillery replied. To the south, the 15th corps was unable to hold its position on the right bank of the Meurthe, at the approaches north-northwest of Lunéville; it was reenforced by a mixed brigade of the 20th corps (General Ferry) on the position at Flainval.

The German forces were assembling from all directions. The army of the Prince of Bavaria was coming from Deline, from Morhange, and, extending as far as Avricourt, with the Grand Couronné and Lunéville as its objective.

The army of General Von Heeringen, debouching from Donon and from the saddles of the Vosges had for its objective, to the south, the line of the Mortagne and the forest of Charmes, where it expected to take in reverse the French forces, which with the mission of defending the gap, were facing northeast. The enemy thus had planned to occupy in force, as an initial base, the region of Lunéville with the 21st corps, and the 2d and 3d Bavarian corps.

The German attack began at 8:30 a. m., Aug 22d, against the positions of our 16th corps, on the heights of Crion and Sionviller.

The 15th corps, not feeling able to hold its position with the Meurthe at its back, was authorized about 10 a. m. to fall back to the left bank. Care was taken in its retreat not to encumber the Lunéville crossings. The 29th division crossed by the Blainville-Damelevières bridges; the 30th division by the Rosières-aux-Salines bridge. The corps occupied the heights of Saffais.

It was necessary to hold positions for as long a time as possible on the right bank. So General de Castelnau ordered General Foch to provide for that.

The latter assigned General Ferry to the task, with the 11th Division ("The Iron Division"), and particularly the 22d Brigade, which had just made a march of 50 kilometers after two days of hard fighting. Without being allowed to rest, it crossed the Meurthe to the heights of Flainval. It was supported by two groups of 75's and two of heavy artillery. It there held out all day (on the 22d), thus preventing the enemy from turning the Grand Couronné toward the south. At night, its mission accomplished, it disengaged itself from the Germans, recrossed the Meurthe, and blew up the bridges behind it.

The day's work on the Rembétant was also well done. The main body of the 20th corps had in the meanwhile established itself south of the Meurthe on the heights of Ville-en-Vernois-Manoncourt and the brow east of Rosières.

The plan of General de Castelnau, who was with the greatest care preparing the defence of Charmes Gap, was to connect up the Rembétant, i. e., the southern Acropolis of the Grand Couronné, with the heights of Saffais (367 meters) and Belchamps (413 meters), which command the plains of the Meurthe and the Mortagne to the north, and at the same time protect the Moselle pass to the south. He ordered that the troops entrench on these positions. Unfortunately they had not learned the importance of entrenching, and did not do it. The cavalry remained immobile above Moncel-Lunéville.

These measures, bringing the troops slightly to the rear, left the field open to the enemy to push ahead toward the Mortagne, to the south of Lunéville.

About 9 o'clock in the evening of the 22d, the 31st division (16th Corps) was forced to begin to fall back. It crossed the Vezouse and the Meurthe at Lunéville, and reformed at Xermaménil. Lunéville was open and defenceless. At 2 p. m. the 23d, Sunday, the Germans marched into its streets with bands playing.

The orders of the 23d of August fully established the connection between the 1st and the 2d armies and gave them an objective in common which was to consist in laying a hinged trap before the imprudently advancing Germans. The platform of the trap was to be formed by Dubail's army which was ordered to form in line along the valley, while the joint or hinge and drop of the trap were to be formed by de Castelnau's army, occupying the heights of the Grand Couronné, crossing the river Meurthe, and extending to the Saffais-Belchamps crest.

When the positions were firmly occupied, the junction of the two armies was to be made on the heights north of the forest of Charmes by the 64th and 74th divisions of the reserve (2d army) which were barring the gap, the 16th division of the 8th corps and the 6th cavalry division (1st army) which on the alert in the region south of Rozelieures and of Borville, were ready to strike at the flank of the German army and to come to the assistance of the neighboring friendly army.

The 2d Army

The 23d was comparatively quiet. De Castelnau's army established itself strongly in its positions, and its commander moved his headquarters to Pont-Saint-Vincent, showing that he intended to watch the region of Charmes, to oppose the right wing of his army to the overlapping movement of the enemy to the south, and to defend the left bank of the Meurthe in prolongation of the Grand Couronné.

He had exercised great care in massing his troops so as to dominate the pass whose strategical and tactical value was of such great importance.

The 16th Army Corps marched to the vicinity of Ferme Léaumont (hill, 352 meters)—Belchamps, commanding the road from Lunéville to Bayon. It consisted of the 32d division and the 74th reserve di-

vision; the 31st division, which had been sorely tried on the 22d in the vicinity of Jolivet, was being reorganized on the Moselle. The 74th reserve division (General Bigot) was assigned the mission of holding the Lunéville-Bayon road. The 63d brigade of the 32d division was placed to the right; one of the regiments of the 64th brigade was placed at Villacourt, south of Bayon, thus lengthening the line of defense to the wooded country about the Charmes Gap. All the artillery of the 16th corps was in line on the ridges of Belchamp, and north of Brémoncourt (hill, 413).

Farther north, the 15th corps assembled on the left of the 16th corps in the vicinity of Haussonville—ravine of Ferrières.

The 20th Army Corps took a position that would enable it to move to the defence of the Grand Couronné if the enemy made an attack upon Nancy, or to move to the defence of the Charmes Gap if, as was probable, he turned away from the city to accomplish the great strategical maneuver.

General Ferry's brigade of the 20th corps had recrossed the Meurthe after having splendidly repulsed four attacks by a Bavarian brigade on the heights of Flainval. The artillery of this corps was in battery on the Saint-Nicholas-Cuite-Fève ridge, dominating the Meurthe and enfilading the valley of the Sânon; it was supported by a brigade of the 11th division and by the 4th battalion of Chasseurs, which constituted a strong guard for the St. Nicholas bridge; for on this point depended the communication between the two parts of the army.

The 39th division (20th corps) was held in reserve at Lupcourt-Manoncourt, behind the corps artillery. The 43d Colonial was sent to re-enforce the garrison of the Rembétant. The divisions of the reserve still guarded the Grand Couronné farther north, their main strength being toward Lenoncourt, ready to counterattack if necessary toward Harancourt or toward Réméréville. Fort Bourlemont had made all necessary arrangements for a vigorous defensive.

A hostile division was reported advancing south on the Château-Salins road; the 2d Bavarian division was farther south on the Sânon (the 3d Bavarian division was toward Maixe). Farther south still, a hostile army corps was entrenching in the region of Maixe-Anthelupt-Flainval. Everywhere the enemy was digging entrenchments as if to protect his right.

On the 23d the enemy made two attacks against the Rembétant: one about 10 a. m. from Dombasle, the other about 7 p. m. thru the Crévic woods. They were both stopped by our artillery.

The 1st Army

The 1st Army (that of Gen. Dubail) was directed from Aug 23, to act in conjunction with the 2d Army. It was none too soon. The enemy had invaded the valley of the Vezouse by every possible avenue of approach, and was marching upon the valley of the Meurthe. Coming from Avricourt, Blamont, Cirey, from Mount Donon, from the saddles of the Vosges to the saddle of Sainte Marie (which had been lost the day before by the 71st division of the reserves), Von Heeringen's army, and the left wing of the army of the Crown Prince of Bavaria formed a vast inclined semi-circle. whose vertex was on the slopes of Donon and the chord (which was the objective) was the Meurthe, with Baccarat as the center. Von Heeringen was coming down this inclined plane in order to help the drive of the center and right wing, namely the Bavarian Army, which was directed upon Rozelieures and the Charmes Gap.

The movements ordered for the 23d, for the 1st French Army, with a view to a later offensive operation, were to bring it faced to the north and northwest in a position perpendicular to the front to be occupied that same evening by the 2d Army.

On the evening of Aug 22, the 1st Army occupied a line whose convexity was frankly northeast. The change ordered by the commander-in-chief for the 23d was to make it convex in just the opposite direction. A series of extensive movements, therefore, became necessary, revolving about the heights dominating the northern edge of the forest of Charmes.

General Dubail executed a conversion of his left and center toward the southwest, in order to establish his connection, in the form of a carpenter's square with the right of de Castelnau's army, which would have its extreme point, on the evening of Aug 23, toward Villacourt, north of the forest of Charmes. The 8th Corps therefore left its cantonments in Verdurette east of Moudon forest, to execute its movement and articulate with the right of the 2d Army, thus leaving, on that day, Aug 23, to the enemy the opportunity of entering the trap.

During the night of the 22-23, the army corps crossed the Meurthe in the midst of a terrific storm; the 16th division (de Maud'huy) received orders at midnight to resume the retreat, the main body of the division being on the left bank, one regiment having remained on the right bank, near Hablainville; the division moved on the Domptail-Saint-Pierremont road, and crossed the Mortagne. On the following day it reached its new position: Fauconcourt-Ortoncourt-Bois du Chanfour—references 361 and 370.

On the evening of Aug 23, the entire 8th corps was on the line Damas-aux-Bois, Haillainville and Fauconcourt. At its left the 2d Alpine battalion had been assigned the duty of delaying the enemy, and particularly of preventing him from crossing the Mortagne before the completion of the withdrawal of the army corps, the reorganization of its units and the connecting up with the 2d Army.

Here took place the heroic defence of Gerbéviller and the Mortagne by Sergeant-Major Chèvre and 54 Alpines of the 2d battalion. They held back an entire Bavarian brigade from 9 a. m. till late that night, inflicting heavy losses on the enemy and escaping in the darkness after the safety of the 8th corps was assured. The enemy was so angered at the delay that he put the village to fire and sword as soon as he got into it.

On the right of the 8th corps, the 13th came down the heights of Montreux to Baccarat, and went into cantonments of Saint Maurice, Roville-aux-Chênes, and

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Anglemont. The 21st corps which had been on the high wooded brows of the Vosges overlooking the Valley of the Plaine, marched to the Meurthe expecting to have to resist the enemy, who was in contact with it, but was not attacked; that night it was in bivouac, faced north, on the line Celles-Pierre-Percée-Pexonne-Merviller-Baccarat-Bois de Glonville—that is, upon the slopes of the forest of the Reclos which overhangs the Meurthe and covers Raon-l'Etape. To the southeast, the 14th corps, having quitted the valley of the Bruche, fell back toward the west, and occupied the vicinity of Ban-de-Sapt.

As the enemy was everywhere in contact, the greatest vigilance was ordered. Preparations were made to meet a night attack.

The Headquarters Staff of the 1st Army had been established at Epinal.

The order for the battle of Charmes Gap was simple. The 1st Army will face the enemy and fight him on the position taken. The 2d Army, placed perpendicularly, will fall upon the enemy's flank if he attacks in the river country southwest of Lunéville.

At midnight, Aug 23-24, the enemy attacked Celles (about 15 kilometers east of Baccarat, on the Plaine River). At the same time he attacked Baccarat from the north and northwest. Our 21st corps was heavily pressed by Von Heeringen's army with superior forces supported by powerful artillery. The 17th and the 21st regiments were slowly driven back into Celles, then to the west of that town, our batteries covering their withdrawal.

A counter-attack made some progress toward the east, but met heavy German artillery fire.

The 13th division was forced to fall back. The 26th brigade was ordered to move toward Etival, covered by the 17th Chasseurs. The 25th moved on Raon. At nightfall the 26th reached Etival, to find it completely occupied by the 27th division of the 14th corps. There was confusion due to the blocking of roads by troops, guns and trains.

The 43d division fell back also thru Baccarat to the left bank of the Meurthe. The 21st corps thenceforth was along the Meurthe. The 14th corps, which was supporting the right of the 21st and holding the line of the Vosges, was in danger, from being too far from the main body of the army; it was therefore moved slightly to the rear, having on its left the 27th division, which as already shown was, at nightfall, in the vicinity of Etival. The front of this corps extended thru Provenchères-Ban-de-Sapt-Moyenmoutier, thus protecting the line of the Meurthe, from Saint-Dié to the vicinity of Raon-l'Etape.

In Alsace, sections of the left of the army of General Pau were still holding the region west of Colmar, at the foot of the Vosges.

Unfortunately a corps of Von Heeringen's Army, which had seized the Col de Sainte-Marie, started down the French slope of the Vosges, and threatened to turn (on the 25th) the troops still holding Alsace in the vicinity of Colmar. This force was also heading for the Charmes Gap, but by way of Saint-Dié and Epinal. The 142d brigade therefore had to fall back to Fraize on the upper Meurthe. General Dubail ordered the 71st reserve division to Epinal, to bar that route. The 58th reserve division was guarding the right bank of the Meurthe south of Saint-Dié. The commander-in-chief put also at the disposal of the commander of the 1st Army the 44th division, which had come from the army in Alsace.

To the left of these French forces (21st and 14th army corps, 58th and 71st reserve divisions, some Alpine detachments which had been near Colmar, and the 44th division from Alsace) holding the Saint-Dié region, there was left an open zone in front of the 13th and the 8th corps, which the commander-in-chief hoped would tempt the enemy. In anticipation of the enemy's moving into this trap, he had caused the 13th corps to move up (about noon the 24th) toward the heights of Ménarmont. In this new position it eased the pressure on the right of the 2d Army, which had been heavily pressed since 10 a. m. The 13th corps thus held the neck of the funnel, insuring, with the 21st corps, the possession of the line of crests, which from Vallois to Etival, runs parallel to the Meurthe and commands its crossings.

The 8th corps prolonged to the west, beyond the Mortagne, the solid line holding the heights. Moving onto the crests of Essey-la-Côte, it protected the very entrance to the gap.

On the whole, the 1st Army while yielding ground, had barred everywhere the enemy's advance.

The 8th corps received the order to counter-attack. It did so toward Vennezey-Moriviller, in the approaches of the gap, around the village of Rozelieures, the objective of the enemy. To aid this movement of the 8th corps, the 13th, protecting its own right on Ménarmont, held the hostile forces overflowing from Baccarat.

General Dubail had accurately complied with his orders. He had executed the great evolution of withdrawal on the 23d; he had held the German troops, on the 24th, on the slopes of the Vosges, while to the west the hostile masses moving on Lunéville and the Charmes Gap had pushed him back slowly (but without breaking thru) to the position prescribed for him—i. e., to a north-northwest line perpendicular to the 2d Army. On the evening of the 24th, his army, exactly at right angles with the 2d army, had its main front, from the Charmes Gap to Raon-l'Etape, while the units barring the eastern route, formed a new line, convex at Ban-de-Sapt.

At the same time, the 2d Army, on the other side of the right angle, was established, from south to north, on the heights of Belchamps, Saffais, and the Grand Couronné as far as Sainte-Geneviève. The trap was well laid. Would the enemy enter it?

While the 1st Army was receiving the shock of the enemy's columns on the Meurthe from Lunéville to Raon-l'Etape, aerial reconnaissance sent out from the 2d Army reported large bodies moving from north to south or southwest. All the information received from contact troops verified these indications. About 11:30 General de Castelnau was convinced that his

dream was to be realized. The German army was not going to move toward Nancy; it was going to pass along the Grand Couronné, and the brow separating the Meurthe and Mortagne from the Moselle. This would leave its flank open to attack from the line of heights, while the Dubail Army would hold it at the south.

General de Castelnau decided to attack the tail of the long advancing column and try to drive it into the trap; and at the same time to move on the flank offered to him. His own right, which would receive the brunt of the German advance, marching toward the gap, was ordered to hold firm at any cost. Accordingly at 11:30, the 39th division of the 20th corps, the 70th division of the 2d group of reserve divisions, the 34th and 39th brigades of the 9th Army Corps, moved out from their positions on the Grand Couronné toward Serres-Hoéville-Erbéviller. The 59th and 68th reserve divisions remained to guard the principal line of the Grand Couronné.

Farther south, a part of the 20th corps marched straight to the front, toward Haraucourt and Flainval.

About 10 a. m. the 24th, the cavalry corps, under General Conneau, was attacked by German forces of all arms, which were coming up or crossing the Mortagne from Mont-sur-Meurthe to Gerbéviller. The cavalry defended itself vigorously, holding till 2 o'clock the Moriviller ridge and the ridge of the Jontois woods, between Einvaux and Moriviller. About 2:30 two German corps debouched from Franconville wood. General Conneau decided to fall back on Borville, which he reached about 4 o'clock, having left the 2d battalion of Chasseurs at la Naguée. From the heights at Borville the horse artillery bombarded the enemy and prevented him from reaching the Naguée plateau. The cavalry corps maintained its positions despite all the efforts of the Germans; it forced them to take all day to advance five kilometers, and it maintained the connection between the 1st and 2d armies. It was about this time that the 8th corps, supported by the 13th (whose right was firmly established at Ménarmont) came into action. The heavy artillery of the 16th corps also came into action from the heights of Belchamps.

The troops of the 2d Army that had moved out on the 24th, attacked the Germans at Erbéviller, Réméréville and Courbessant, forcing them back on the Serres ridge. The 20th corps, by nightfall, had occupied the front Haraucourt-Flainval-Rosières, maintaining connection with the 15th corps thru Saffais.

On the morning of the 25th, the 21st and the 13th corps, forming the center of the 1st French Army, were attacked by large forces. At 2 p. m., after 10 hours of fighting, the 1st and 2d battalions of the 109th were forced to fall back from Fagnoux. They bivouacked that night on Hill 423. The 21st regiment of infantry fell back at night to the Col de la Chipotte. About noon, the 13th and the 21st corps had withdrawn before heavy pressure from the woods of Glonville and the position at Ménarmont, which protected Rambervillers. General Dubail had thrown forward the 44th French division, which he had been holding in reserve, to cover the withdrawal. In falling back to the positions on la Chipotte, General Dubail reached the ground where his magnificent defensive was to prevail over the German offensive. It was by contesting every foot of ground, and inflicting heavy losses upon the invaders, that General Dubail prevented the Germans from carrying the gap. The Germans were so angered at the delay, that they sacked and burned Raon-l'Etape and other villages, and one of their brigades massacred all prisoners.

In the night of Aug 24th, General de Castelnau, who realized that the key to success lay at Borville (near Rozelieures), caused all the available artillery, which he knew must play a gigantic rôle in deciding the battle, to be brought up to the plateau of Borville. From there at dawn it commanded the roads converging on the Charmes Gap (the railway from Blainville to Bayon and Charmes, the roads from Gerbéviller, Xermaménil, Dameleviéres), the slopes of Jontois woods, Filière woods, the slopes of Rozelieures, and the hill at Essey. His plan for the morrow was as follows: If Prince Rupprecht's army continues to move south, it will be stopped between the Mortagne and Borville by the 16th corps, and a division of the 15th, or finally by the 8th corps, while Von Heeringen's army, moving west, with the intention of using the big Raon-Rambervillers-Charmes road, will meet the obstacle formed by the 1st Army on the heights north of that road. In addition, if the enemy continues to offer his flank, the opportunity will be seized to fall upon his communications. General de Castelnau, whose army extended over 60 kilometers, from Sainte Geneviève to Borville, had a marvelous grasp of conditions and their possibilities, as was shown by the circumstances of the campaign. He directed operations from Pont-Saint-Vincent, 25 kilometers in rear. Precautions having been taken for the defence of Nancy and the Grand Couronné, in case of attack, and connections established along the whole front by the heights of Saffais-Belchamps, the offensive had been organized against the main line of communications of the enemy, which appeared to be the road from Arracourt to Einville and Lunéville. The French troops that have retaken Réméréville will try to reach that line of communications by the banks of the Sanon. The 20th corps will continue to press the enemy, keeping connection with the reserve divisions operating on its left. Its objective is Flainval, and beyond. General de Castelnau seeks to temper the ardor of his men rather than to excite it. He has ordered that they shall proceed slowly, methodically, consolidating after each advance, so as to save blood and strength; notably he has ordered the 16th corps (which was so severely tried at Angweiler and Gosselmingen), not to risk itself without maintaining the closest connection with the 8th corps.

In the morning it was obvious that the Germans had decided to ignore the French troops left by them on their right, on the Grand Couronné, and to march straight for the gap and carry it at any cost. Prince Rupprecht's plan was to carry Mononviller by a fierce attack, and by bringing heavy masses up both banks

CHARMES GAP, Battle of—Continued

of the Mortagne, to break all resistance, and to open to the German armies the road of Mirecourt-Neuf-Château. Such a tactical success would insure the best strategical success that an army could hope for. The Schlieffen idea would be carried out just as it had been in the barrack areas, as in the school of the battalion.

At dawn Aug 25, the 8th corps, which Gen Dubail had destined to a counter-attack against the enemy, was fiercely attacked by the Germans.

It received a terrible artillery bombardment, while the hostile infantry sought to cross the heights southwest of Remenoville toward Rozelieures. General de Castelnau immediately issued orders to meet the situation. He ordered the 16th and the 15th corps forward, at the same time he ordered the detachments in the vicinity of Borville to press forward toward the enemy. The cavalry was ordered to cover the 8th corps as it moved into action toward the north, while the 16th corps, which was re-enforced, was to attack toward the east (Einvaux-Franconville). The 16th corps entered Einvaux (a village on the road thru the gap, north of Borville); it pushed on eastward into the Jontois woods.

The left regiment of the 8th Corps was driven from Rozelieures about 10 o'clock, and it looked as if the enemy might carry out his plan of forcing the entrance to the Gap, but General de Castelnau had kept some troops in hand. He ordered the Cavalry Corps to oppose the enemy with all its might in his advance on Saint-Remy. The 2nd battalion of Chasseurs, supported by dismounted cavalry, recaptured the Lalau Woods. They held it till nightfall, in spite of severe losses, while the 16th Corps to the west attacked in flank the forces opposed by the cavalry. General de Castelnau showed his extraordinary vigilance and clear-sightedness in his order to the 16th Corps, which he directed to attack the Filières Woods, urging it not only to hold the enemy, but to beat him at that point, which he said was of the greatest importance. It was by striking the enemy in flank that he was to be prevented from advancing at the front.

The 29th division of the 15th Corps was attached to the 16th Corps, and the rest of the 15th was sent to support the 20th on the south bank of the Meurthe.

These movements astonished the enemy. About 2 p. m. fractions of German infantry were seen falling back, under the bombardment from the artillery at Borville and the menace of the 16th Corps on its line of retreat, from Rozelieures toward the Rechimont Woods, between Remenoville and Filière Woods.

The French cavalry immediately followed up this movement. The 6th division (cavalry), re-enforced by the 2nd battalion of chasseurs and the 2nd group of cyclists, with the 2nd brigade of dragoons, occupied the north edge of Lalau Woods, at the top of the slopes leading down to Euron Creek. The 12th brigade of dragoons took possession of Saint-Boingt; finally the infantry of the 16th Corps moved from Borville on Rozelieures.

It was a helping hand for the 8th Corps, which had already partly fallen back on the line Rehaincourt-Saint-Genest, between the forest of Charmes and Rambervillers. The 8th thereupon moved forward again, to retake, toward Essey-la-Côte, the ground it had lost.

It was the decisive moment of the battle. General de Castelnau wired the order, "Forward, everywhere, to the finish." It was an admirable order, issued at the psychological moment, and revealed a master's estimate of the situation and decision. The whole army moved out. The enemy resisted desperately. Convinced of victory, he would not acknowledge defeat; but he was beaten.

At the end of the day, the 16th Corps had Rozelieures and the crest of the Naguée farm, between Moriviller and Jontois Wood. The 15th Corps, after a magnificent fight, reached the Meurthe and the Mortagne at Lamath and Blainville, pushing close to Lunéville, but its own fatigue and the desperate resistance of the enemy stopped it at the entrance to Mont-sur-Meurthe. Damelières bridge, Réméréville and Erbéviller were ours.

The Cavalry Corps was ordered to pursue by the right on the Mortagne in the general direction of Gerbéviller, Fraimbois, Lunéville, Vallois, Saint-Clément, Einville and fall on the southern flank of the retreating hostile columns. But unfortunately, the horses, worn out by two days of fighting, could do no more, and the Germans were too firmly established on the right bank of the Mortagne, in which direction the pursuit was also soon interrupted. However, the front of the 8th Corps was disengaged and the French troops found the Germans falling back everywhere.

On the left, whether thru chance or a favorable circumstance, a Bavarian Corps (probably the 3rd), acting as flank guard for the 6th German Army, on the heights of Flainval, was able to check our 20th Corps. The 39th division of this corps pushed with difficulty thru to the Crevic Woods, which were taken, lost and retaken several times. It finally drove the 3rd division of the Second Bavarian Corps from the ridge 316, north of Maixe, but it was stopped by a heavy cannonade from the heights of Flainval, made possible by the check of the movement on Flainval.

The 70th reserve division was checked north of Hoéville, and fell back to Champenoux Forest, where it took up a position. The 34th and 35th divisions of the 9th Corps also fell back. These troops held at nightfall the eastern edge of the Forests of Champenoux, Saint-Paul, and Buissoncourt, and the heights in rear. The enemy withdrew also, bringing about that curious situation which has often occurred in this war, where, on account of the mutual invisibility of the field of battle, both sides have withdrawn. At the end of the day the 20th Corps occupied, with the 11th division, the heights of Sommerviller, Flainval and Hudiviller, and with the 39th division, the front Saint-Nicolas-Manoncourt. Everywhere the enemy had been held or put to flight. It had been a successful day; it came near being decisive.

From this battle, in which probably half a million men took part, was obtained a great strategic result. The enemy failed to penetrate the Charmes Gap, and that was the decisive point which concerned the whole campaign for France. The strategic result was twofold and the importance thereof cannot be exaggerated. On the one hand it affected the great German plan of crushing the French Army by strangulation and thereby disposing of France in six weeks. On the other hand, by holding and throwing back soon thereafter to the frontier the German left wing in Lorraine, it gave the French General Staff the opportunity to move a large part of these troops from the east to the west and to use them against the German right wing of invasion, and that was an essential condition for victory for France.

The tactical results were not less important. They developed in the succeeding days. General de Castelnau victoriously repulsed the assault made in the presence of the Emperor upon Nancy, which the Germans wanted badly as a trophy to recompense them for their defeat at the Charmes Gap. Also when General Von Heeringen hurled himself upon Saint-Dié and the Col de la Chipotte, we defeated him, and forced him precipitately back to the frontier and the saddles of the Vosges.

The battle of the Trouée de Charmes makes one of the brilliant pages of the war.

The Germans' genial conception of the campaign was "Total destruction of the enemy's armies by an enveloping movement of the two wings, the center advancing to deliver the decisive blow." It is the pincer or tongs strategy.

The Schlieffen system was also defeated in the battle of the Marne. But the true story of the battle of Charmes Gap has not been thoroly known. The Germans did all in their power to conceal the facts. We surprised a German radiogram which stated, "Under no circumstances reveal to our armies in the west the checks received by our armies in the east."

Since then they have continued their efforts to suppress the facts in regard to this important campaign. We have the greatest interest in publishing the truth, which redounds to the glory and honor of our soldiers and their leaders.

CHILE

—Army

See

COURTS-MARTIAL—CHILE

[Orientation of the Services of the Experimental Commission of the Army and Its Reorganization upon Modern Lines. By Col. E. Medina. *Memorial del Ejército de Chile,* May, '17. 3500 words.]

This Commission was organized by a Decree of May 3, 1911. It consists of 3 officers, the senior two of which must have taken the complete artillery course at the Technical Military Academy of Berlin.

The Commission has two sections. The 1st section is charged with (a) Testing the latest inventions in arms and munitions;

(b) Seeing that all arms and munitions received at depots conform to specifications;

(c) Maintaining up-to-date the technical data relating to all classes of war material.

The 2d section is charged with, (a) Experimenting with and proving appliances and explosives for military demolitions;

(b) Studying and passing upon questions referring to transportation and storing of arms, munitions and explosives;

(c) Inspecting material other than arms and munitions in order to prevent the purchase and storing in supply of inferior articles.

The defect in the new organization is that the Commission is now largely subject to the direction of the Bureau of Material instead of being directly under the Minister of War.

This Commission in the hands of the Minister of War would constitute an organ of technical control of the government and also a fount of technical information which would assist the Minister of War in solving all problems relating to war material.

Without this organ the Minister is obliged to accept blindly whatever the Bureau of Material chooses to propose.

The Commission should therefore function directly under the Minister of War as do those of such model military organizations as the German, Japanese and Italian.

—Army—Reserve

[The Problem of Our Reserves. By Capt. Bari. *Memorial del Ejército de Chile,* May, '17. 1200 words.]

(An article calling attention to the fallacy of the popular idea that reservists who have had but one year of training with the colors are able and fit to go to war under modern conditions. The writer holds that reservists, upon return to civil life lose touch with military affairs and soon forget even the fundamental principles of their military training. They are in no sense soldiers fit to train new troops while the first line troops are containing the enemy. A closer relationship than the actual one is urged between the army and the reservist who has completed his year of service with the colors.)

—Army—Sanitary Service

[Military Sanitary Service. By J. Ostornol. *Memorial del Ejército de Chile,* Sept, '17. 5000 words.]

The brilliant progress attained recently by the Sanitary Service, which has contributed so much to the health of modern armies, and to their efficiency in battle, is due not so much to the competency as surgeons of medical officers, as to the proper organization and preparation during peace of the sanitary elements that are necessary for war. In a modern army these elements are found at sanitary depots in such condition as will permit their rapid mobilization for war.

The duties of the Sanitary Service in war may be summarized as follows: to prevent sickness, to collect, receive, care for, cure, and return to duty the wounded; to remove the wounded from the field of battle, and to provide for their evacuation to the rear.

CHILE—Continued

In order to accomplish its mission in war, the Sanitary Service must be provided with all classes of sanitary material, and with the necessary means of transportation.

(The writer concludes that the Sanitary Service of the Army of Chile is not prepared at present to perform the duties that would fall to it in war. He invites attention to the following deficiencies:

(a) The scarcity of surgeons and of sanitary officers of the junior grades, and the lack of nurses.

(b) Lack of standardized instruction thruout the army of the commissioned personnel of the Sanitary Service in tactical studies.

(c) The lack of a school or military hospital for professional medico-sanitary instruction of sub-officers (*practicantes*) of the Sanitary Service.

(d) Lack of instruction and of special preparation for nurses and hospital attendants.

(e) The lack of a law guaranteeing their positions to military surgeons and providing for their future careers within the military institution.

(f) The failure to utilize as military surgeons medical students who, in compliance with the Law of Military Service, are called to the colors on each year of conscription.

A project of the Surgeon General tends to normalize the latter situation. He proposes for medical students three months of military service as recruits during the vacation period, this to avoid interference with their studies, and at the termination of their studies, nine months of service in military hospitals, or in the Experimental Section of Hygiene.

During their period of service with the colors the conscripts who aspire to become surgeons will be placed on duty in infirmaries and will devote their time to study of the Service Regulations, and to the instruction of the attendants and military nurses.

At the completion of their period of service and having been found qualified, they will be awarded diplomas and commissioned as Surgeons in the Reserve. Those who do not wish to become surgeons will perform the duties as indicated above during the period of service with the colors. They will not receive the title of Doctor until they have complied with the Law of Military Service.

If sufficient funds could be allotted to provide material now lacking, this project and others advocated by the Surgeon General, should operate to render the Sanitary Service adequate in the progress and advancement of the Military Institution of Chile.

—Army—Schools and Training

[Advantages of a Special Course for Captains at the War College. By Capt. Argandoña. *Memorial del Ejército de Chile,* May, '17. 1600 words.]

The program of instruction for the corps of officers generally is that included in the following courses:

(1) Academies.
(2) Instruction during winter months.
(3) Conferences given the personnel of troops.
(4) War games.
(5) Tactical journeys.

Study of the various regulations at academies is necessarily superficial because of the limited time alloted (one hour weekly for each arm).

The winter work is but little better as it consists mainly of themes assigned to officers by unit commanders, which as a rule treat exclusively of one arm only.

Of conferences but little can be said, as these are for the purpose of teaching incidents of military history to the conscripts.

If more time were given to war games in all garrisons, the advantage to officers would be great. Unfortunately this work is not given the importance that it deserves. There are officers of fourteen years of service who have never participated in a war game and who only know of such a thing by hearsay.

War games are of the greatest value in military instruction. They do not treat exclusively of one arm but require a study of all regulations and the application of the same. They require estimates of situations, decisions and the issuing of orders to carry into effect the latter.

The organic act of the army of 1906 created schools for officers which reasons of economy have not as yet permitted to function. Since these cannot be counted upon, a greater number of officers should be allowed to attend the war college and a special course for captains to last for one year is advocated.

—Compulsory Military Service

See also
Chile—Military policy of

—History

See also
Chilean-Peruvian war
Concón, Battle of
Rancagua, Siege of
South American war for independence

[The Route of San Martin. By Maj. Charpin. *Memorial del Ejército de Chile,* May, '17. 4500 words.]

(A description of the route over the Andes followed by General San Martin in 1817. General San Martin crossed his army by the Pass of Las Yaretas. It is only when one has transversed this route that the careful preparation incident to taking an army over it can be comprehended. One may then appreciate to their fullest extent the magnitude of the liberating expedition, the forethought and clearness of vision of the commander, the importance of the interests at stake, and the difficult nature of the obstacles that had to be surmounted.

This remarkable accomplishment marked with success the first step of General San Martin's vast plan against the Spaniards.)

—Military Policy of

See also
Education, Military—In schools and colleges

[Compulsory Military Service and Nationals. By Captain Marcial Urrutia. *Mem. del Ejército* (Chile). Feb, '17. 2000 words.]

The double nationality of some of the residents of a country is a very serious problem which deserves a careful study from all American governments.

During the progress of the European war, we have seen many subjects of the belligerent nations return to their native land to offer their services. All said subjects may be classified under four heads:

1. Foreigners, residents of Chile and who have not taken out citizenship papers.
2. Foreigners, residents of Chile, but who have taken out citizenship papers.
3. Chileans, sons of foreigners, who may or may not have taken out citizenship papers.
4. Chileans, sons of Chilean citizens, who have enlisted in one of the belligerent armies.

The departure of so many ablebodied persons has an important bearing on the economic life of a nation.

The government should have opposed the departure of the sons of aliens and who were born in Chile, of naturalized citizens, and of native-born Chileans. In the new law of recruiting, which is being drafted by the War Department, it is well to consider the following points:

a. The obligation of every Chilean who is not exempt from military service to inform the designated officials of his intentions to go abroad.

b. The obligation of said official to furnish a certificate bearing a photograph of the petitioner, which will serve as proof that notice has been given of the intention to leave the country.

c. The duty of all transportation companies to furnish the authorities with a list of passengers to be transported abroad.

d. The obligation of the competent authorities to inspect all ships or conveyances leaving the country to ascertain if all citizens of military age are provided with the required certificates showing that due notice has been given of the intention to leave the country.

e. The obligation of all citizens to register abroad with the diplomatic and consular representatives.

f. The obligation of all citizens who have resided abroad to report to proper authorities upon their return to Chile.

Attention is invited to the danger involved thru the application of Article 25 of the German law of July 22, 1913, which prevents a German subject becoming a naturalized citizen of another country without forfeiting his original nationality, and thereby increasing the number of citizens with double nationality with whom the government has to contend.

—Military Topography of

[Exploration Made on the Peninsula of Taitao. By Maj. Blanche E. *Memorial del Ejército de Chile,* May '17. 3100 words.]

(The personnel of this party consisted of three army officers, an astronomer, a medical officer, a botanist, a zoologist, five soldiers and sixteen workmen. The expedition spent 48 days on the Peninsula between dates of Jan 4 and Feb 20, '17. Shortage of provisions, especially of salt, necessitated the return before the exploration was completed. The country was found to be very healthful with an abundance of excellent timber for building purposes. The soil is rich and productive.)

["Influence of the Topography of Northern Chile on Military Operations." By Maj. Wegmann. *Memorial del Ejercito de Chile,* Aug, '17. 5200 words.]

(A study from the military point of view of the resources and topography of Northern Chile with reference to military operations in this theater. The conclusions of the writer are as follows:)

1. That the resources of the country are insufficient to supply at the same time necessaries both for an army and for the native population.
2. That all operations in this northern region would necessarily be based upon existing lines of communication.
3. That because of the scarcity of forage and of water, the character of the soil, and the lack of roads, it would be necessary to use modern mechanical means in supplying an army. Automobiles, auto-trucks and field railroads would be necessary.
4. That the existence of numerous ridges and valleys would render operations exceedingly difficult and that a study should be made in time of peace of the best method of constructing passages across these.
5. That military operations would of necessity be confined to movements along such few railroad lines as are in existence; this because potable water is available in abundance only along such lines.

To obviate the foregoing inconveniences, it would be necessary—

1. To augment the carrying capacity of longitudinal railroad lines, and to improve the water supply of the trains, both for men and animals.
2. To construct the railroad sector lacking between Zapiga and Arica; and to place the third rail in the sector Pisagua-Zapiga-Pintados-Iquique.
3. To standardize the railway tracks on the north.
4. To eliminate switchbacks in longitudinal lines.
5. To make a practical study of the hydrography of the northern regions with a view to finding a practical system for obtaining water and purifying it, in various parts of the desert.
6. To make a practical study of the use of automobiles with wheels of the type used on "tanks" as a means of transportation in general, and especially for carrying water.
7. To require the railroads to maintain a reserve stock of coal for use in case of suspension of maritime traffic.
8. To organize large storehouses of food and supplies for use during the first period of operation.
9. To work out a practical scheme for the passage of ravines and ridges by auto-cars and field railways.
10. To establish a plan for developing the agricultural and cattle raising resources of this region.

CHILEAN-PERUVIAN WAR

—Railroads in

[The Use of Railroads. By Colonel H. Bertling. *Mem. Del. Ejército* (Chile), Jan, '17. 2500 words.]

(A study of the use made during the Campaign of Tarapacá (Chilean-Peruvian War) of the railroads located in the theater of operations. These railroads, built for commercial purposes, could not be considered as strategic lines of communication. Nevertheless they played an important rôle in the military operations.)

CHINA

—Foreign Army Service in

[China Service. By Lieut. W. R. Wheeler, U. S. A. *Journal Military Service Institution,* Sept-Oct, Nov-Dec, '16. 12,000 words.]

(A very personal description in detail of the appearance, characteristics, and routine of the various military establishments representing the World Powers in China, before the War of 1914.)

CHLORINE

See

ASPHYXIATING GASES

CIVIL WAR (U. S.)

See

COMPULSORY MILITARY SERVICE—IN THE CIVIL WAR (U. S.)

LEE, ROBERT EDWARD

[The Campaign of the Squirrel Hunters. A Reminiscence of 1863. *Jour. Military Service Institution,* Jan-Feb, '17. 3500 words.]

[An historical sketch treating of General Morgan's last raid.]

CLAUSEWITZ, Karl von

[The Founder of German Militarism. By Maj. T. E. Compton. *United Service Magazine,* Dec, '16. 2800 words.]

(Discussion of the influence of Clausewitz's writings on German militarism.)

CLOTHING, Military

See

PAPER—USE OF FOR CLOTHING

UNIFORMS

[Clothing the Army. *Army & Navy Gazette,* Mar 3, '17. 125 words.]

Some remarkable figures are included in the following statement of quantities ordered on War Office contracts from Aug 4, 1914, to Dec 31, 1916 (including contracts by the War Office on behalf of the Allied Governments):

Boots	pairs	34,524,000
Cap-Comforters		13,326,000
Drawers—		
Cotton	pairs	5,689,000
Woolen	"	20,959,000
Flannel	"	1,037,000
Cotton and Woolen, short	"	1,584,000
Gloves, woolen	"	8,382,000
Socks, worsted	"	63,565,000
Vests, woolen	"	9,401,000
Vests, flannel	"	974,000
Blankets		21,175,000
Cloth for Jackets	yds.	42,330,000
Cloth for Trousers	"	23,687,000
Cloth for Greatcoats	"	21,558,000
Barathea	"	2,360,000
Bedford Cord	"	2,305,000
Whipcord, drab	"	6,064,000
Flannel for Shirts	"	105,102,000
Flannel for Hospital and miscellaneous	"	7,244,000
Duck (tent, cotton)	"	38,060,000
Drill (khaki, cotton)	"	20,870,000
Drill, drab, cotton	"	40,516,000
Cotton, grey	"	11,041,000
Jean, cotton	"	46,853,000
Flannelette, cotton	"	23,344,000

CLUBS, Military

Spain

[The New Army and Navy Club, What It Was, What It Is and What It May Become. *Memorial de Caballería,* Dec, '16. 3500 words. 9 illustrations.]

A description in detail of the Army and Navy Club (*centro*) in Madrid newly completed, and inaugurated on Nov 16, '16. The library contains more than 22,000 volumes, among which are many rare books. The following pertaining to the Cavalry arm are mentioned in order that the reader may judge of their value.

Libro de la Jineta en España, date 1598.
Arte Militar—Tratado de Caballería, date 1536.
Reglas de la Caballería de la brida, date 1577.
Los commentarios a Cayo Julio César, date 1498 (incunabulum).
Doctrinal de Caballería. A very rare book, date 1487.
Doctrinal de Cazadores, date 1543, valued at 4000 pesetas.

His Majesty the King was present at the inauguration and in an eloquent speech felicitated the assembled officials upon the completion of this splendid edifice. It is expected that this meeting place of the services will become the technico-military center not only of the army but of all Spain, and that from it will radiate the highest ideas of duty and patriotism.

The building and furnishings cost approximately 1,700,000 pesetas.

COAST ARTILLERY

See also

COAST DEFENSE

—Defense Against Aircraft

[Anti-Aircraft Defenses for Coast Fortifications. By Maj. Thomas Q. Ashburn, C.A.C. *Aerial Age Weekly,* Sept 3, '17. 1200 words. Illustrated.]

In the study of such a subject the first step is to determine what types of aircraft will be used, how they will be used, and what purposes they are designed to accomplish. There are three conditions under which the defenses may have to contend with hostile aircraft. (1) When the fleet has a sufficient number to control the air. (2) When the hostile aircraft are approximately equal. (3) When the aircraft of the defenses are powerful enough to control the air. Under any and all of these conditions some one of the following objects is designed to be accomplished by the fleet air-craft. (1) To reconnoiter and dis-

cover the location of the various elements of the defenses. (2) To control the fire of the enemy's ships against land batteries and hostile ships. (3) To bombard.

We will assume that the enemy has gained control of the air, but that the defenses still have a few airships of all types available. A scout machine can do material damage in locating the various elements of the defense if unmolested. At the beginning of the war, photographs and sketches were made from 500 to 2000 ft. The limit at which they are now made is practically 5-6000 ft., but may be as high as 8000 ft. and perhaps more. The United States considers that the "safe" altitude is not less than 12,000 ft.

Drop bombs are classified as light weight, medium weight, and heavy. The light weight bombs vary from a few pounds to 15 pounds, the medium weight from 15 to 50 pounds, and heavy bombs, which go no higher than 100 pounds in our service, may range as high as 200 pounds. In a few isolated cases bombs weighing as high as 400 pounds have been used. The question for the defense, then, is to provide means of keeping the bombing planes at least 6000 ft. up in the air. The problem offered by the "spotters" is a different one. If they can be kept at 10,000 ft. spotting will be extremely difficult for them, and due to the film of smoke which will arise from the shore-guns, it may safely be assumed that if their spotting is to be of any value, they must be at least within 6000 ft. of the striking points of the shells. Shrapnel, or small arms fire will only give effective hits when they strike the personnel, gasolene tanks, delicate parts of the motor, the propeller, and controlling parts of the mechanism. The detonation of a medium caliber, high-explosive shell within 100 ft. of an airplane might cause the plane to dive or capsize, but would not necessarily wreck the machine. The maximum vertical range for small arms has been determined to be approximately 10,000 ft., and at 4000 ft. the striking velocity is only 900 ft. per second.

The Ordnance Dept. has determined that a 3-in., 15-pounder, having the same general construction and ballistics of the 15-pounder, model of 1903, with a 7-caliber ogive, will give a maximum altitude of 30,000 ft. when using a muzzle of velocity of 2600 ft. per second. There is an advantage to the defenses in the fact that their airplanes are not burdened with drop bombs, can climb faster and out-maneuver the raiders who may be forced to drop their bombs prematurely in order to get away safely. We must keep the scouts and destroyers at least 6500 ft. away if possible, and if they still continue to sweep down, to attack them with machine guns. Evidently the best means of attack by guns is to direct a group of shots ahead of the target, calculating to create a dangerous zone thru which the aircraft must fly. It should also be remembered that there will be no time for relocating against aircraft traveling 60 miles an hour or more.

(1) The most effective fire and fire control will be obtained by locating the guns in groups of four, each gun at the corner of a 200 ft. square with the director at the center. (2) The emplacements should be so located as to prevent hostile airplanes from reaching the positions being attacked, and should be able to bring a converging fire on any airplanes that are successful in obtaining that position. (3) A single gun or group of guns defending any point should be at least 1000 yards from that point. (4) The emplacements should be mutally supporting. (5) Machine guns in groups of four or six should be located very close to the positions to be defended.

—Fire Control

[Fire Control System and Field Plotting Board for Indirect Laying of Seacoast Guns and Those of the Mobile Artillery. By Capt. W. T. Carpenter, C. A. C. *Jour. U. S. Artill.*, Sept-Oct, '16. 3500 words. 3 figs.]

The following is suggested as an economical method of fire control for indirect laying, especially suited to the troops of our coast artillery in directing their guns against land targets.

The methods of controlling the fire of guns by indirect laying depend upon accurate information of the position of the target with reference to the gun. The target may be located and its position designated to the guns by any one of several methods, but it is essential that the method be quick and accurate.

A complete system of observation stations, placed well to the front on the landward side, should be adopted, and the positions of all the stations accurately located by triangulation. All approaches within twenty miles should be covered. Good maps, scale 3 inches to the mile, should be prepared, and the stations should be plotted thereon and each given a number. The map should be divided into squares, 1000 yards to a side, the sides of the squares running north and south and east and west. Each fort, fire, and battery commander should be provided with a plotting board bearing a map of the area within the field of fire of his command.

The stations should be manned by observers and telephone operators. Stations should be connected with each other and with the fort commander's station by telephone, using commercial systems as much as possible. Each station should contain an observing instrument, a field plotting-board, two field-glasses, a flag kit, and two telephones.

The field plotting-board is a white pine board, 3' x 3' x 1", on which is mounted a light blueprint of the local area. Two clear, transparent celluloid or xylonite protractor sheets, with brass sighting arms, go with the board. One protractor and sighting arm are centered over the home station and fastened to the board. The other is left unattached for use in laying off data obtained from any other station.

Positions of targets may be determined at the fort commander's station by ranges and azimuths from observing instruments, or by azimuths from two stations. The positions of targets also may be obtained at the stations without the aid of observing instruments, by sighting on the target with the sighting arm after orienting the board, which gives the azimuth from the local station. By means of its azimuth from another

COAST ARTILLERY—Continued

station, determined similarly thereat, the target is located in the proper square. The description of the target, the number of the square, and its position by rectangular co-ordinates in the square are telephoned to the fort commander, who transmits the information to the battery commander as "Field Battery, Square 523, Position 86-23." The battery commander, from his plotting-board, determines the range and azimuth from his battery.

The fire is observed, the fall of the shot plotted in the same manner, and the position of the point of striking is sent to the battery commander, who determines the corrections for the next shot.

The latter method also can be used in connection with a field battery, the battery commander determining his firing data and corrections from the location of the target and fall of the shots as furnished him by the observing station.

The plotting-board is inexpensive and will give fairly accurate results.

—Fire Control—Instruments and Equipment

See also

PERISCOPES—FOR ARTILLERY

—Instruction and Training

See also

COAST ARTILLERY—TARGET PRACTICE

[Service of the Piece Game. Taken from C. A. Bulletin, No. 43, N. G. N. Y. *Jour. U. S. Artill.*, May-June, '16. 500 words. Illus.]

This game was originated by Captain Wm. A. Trull, 30th Co., 8th C. D. Command, New York, and has been found most useful for instructing cannoneers in the service of the piece.

It consists of a large board showing the gun on its carriage in horizontal projection, and a lot of numbered cards representing the cannoneers and other cards representing the implements used in the service of the piece. The game consists in placing these cannoneers and implements about the gun in the places in which each belongs when executing the various commands.

[The Employment of Silhouettes in Identification of Naval Targets for the Coast Defense. By Capt. E. Eckström, Royal Swedish Coast Artillery. *Svensk Kustartilleritidskrift*, Part 1, '16. 2800 words. 41 figs.]

(A condensed translation from *Mitteilungen über Gegenstände des Artillerie und Geniewesens*, 1913.)

[Preparedness of Fort Commands. By Capt. P. H. Worcester, C.A.C. *Journal U. S. Artillery*, July-Aug, '17. 6000 words.]

As the Navy and coast fortifications constitute our first line of defense, both must be ready for action. The coast artillery in its rôle as defender of naval docks and storehouses, harbors of commercial and strategic importance and vantage points for hostile oversea expeditions, must be effective at the outbreak of war. The basic principle of preparedness is that the normal organization of fort commands must provide for an effective emergency use of the fort in action, together with a subsequent passage to a complete war organization without disruption of, or even interference with, the efficiency of the fort as a defensive unit.

This basic principle requires:

1. That the normal personnel be assigned to the elements of defense which require manning in an emergency action.
2. That the personnel be available at all times and continuously, if necessary, for use at these elements.
3. That this personnel be thoroly instructed and drilled for service with these elements.
4. That the division of this fort personnel into administrative units be governed by the requirements of the various tactical commands.
5. That the whole tactical personnel from the fort commander down, be able to maintain perfect teamwork.
6. That officers assigned to tactical elements of defense develop these elements and themselves to meet every tactical situation.
7. That apart from the tactical personnel, a portion of the garrison be assigned to supply and administration, thus permitting post operation without interfering with the tactical handling of the fort.
8. That war plans be developed so completely, and familiarity with the details of them by all concerned be so thoro, that passage to war conditions will be simple, orderly and effective.

(Then follows a detailed discussion of the above principles with a concrete example of how the personnel at Fort Terry, N. Y., should be assigned.)

—Matériel

United States

[The 25 Kw. Gasoline Driven Generating Set Used in the Coast Defenses of the United States. By Mr. Lorimer D. Miller, Electrical Engineer. *Jour. U. S. Artill.*, July-Aug, '17. 8000 words. Illustrated.]

To generate electrical energy at our seacoast fortifications under the unusual conditions caused by the military nature of the installations, there has been developed a compact, semi-portable, easily operated, gasoline driven power unit know as the "25 Kw. Generating Set." 270 of these sets have been installed at a cost of $1,250,000. This satisfactory power plant was developed thru the efforts of a board of engineer officers under the direction of the chief of engineers in 1906 and 1907. After exeprimerts with various kerosene and gasoline sets, the Board finally obtained from the General Electric Co. the finished 25 Kw. set now in use.

(The article gives a detailed description of the Generating Set, of its installation, and of its operation.)

—Matériel—Guns

[The New 16-Inch Coast Defense Gun. *Scientific American*, Mar 3, '17. 1500 words. Illustrated.]

The new 16-inch, 50 caliber coast defense gun will have a muzzle velocity 2700 feet per second with an energy of 121,430 foot-tons, according to ballistic data. The extreme range will be 27 1/3 miles and the maxi-

mum ordinate of the trajectory 44,100 feet. The gun will weigh 340,000 lbs. The weight of the projectile will be 2400 lbs. It will penetrate 12 inches of armor at all ranges.

—Range Finding

[Range Travel Set-Forward Device. By Capt. H. W. Bunn, C. A. C. *Jour. U. S. Artill.*, Sept-Oct, '16. 400 words. Illus.]

This is a device by means of which travel during an observing interval of one minute plus the time of flight, and for any rate of travel from 50 to 300 yards per minute, may be read off directly in yards.

It consists of a chart, divided by horizontal and vertical lines into squares, mounted on a drum. The drum revolves in a suitable frame.

On one side of the chart are ranges, and in the squares in the same horizontal line are set down the travels in yards at that range during an observing interval of one minute plus the time of flight for speeds varying by ten yards per interval.

The advantage of the device is the speed with which the data are obtained.

—Range Finding—Instruction and Training

See also

COAST ARTILLERY—TARGET PRACTICE

[Electric Harbor Boat for Militia Coast Artillery Armories. By Lieut.-Col. W. I. Taylor, C. A. C., N. G. N. Y. *Jour. U. S. Artillery*, July-Aug, '16. 400 words. Illus.]

Considerable difficulty has been experienced in New York Coast Artillery armories in obtaining a target that would move at uniform speed for vessel tracking drills.

To overcome this difficulty a miniature harbor boat was devised. The driving apparatus is a G. E. vehicle type motor, rated at 12 volts, 11 amperes at 800 r. p. m., furnished power by a ten-cell Edison storage battery, type B-4. The boat is steered by hand and may be made to travel in any direction on the floor. It has three variations in speed ahead and two astern, the maximum speed ahead corresponding to an actual speed of about 18 knots, at the scale of the armory and the plotting boards used therein.

—Range Finding—Plotting Board

[The Gebelin Relocator. By Ord. Sergt. John Gebelin, U. S. Army. *Jour. U. S. Artill.*, Nov-Dec, '16. 7500 words. Illus.]

This relocator was designed for use with field guns in connection with land defense of coast forts, but it can be used as an emergency position finder for any gun or battery, relocating the target from the data given by any position finding system in the post.

The outside dimensions of the board are 37x26½ in. and the scale 100 yards to the inch. Any other scale may be used.

The data necessary for its use are: the coordinates of the gun or battery with reference to some station or directing point of one of the position finding systems of the post, and ranges and azimuths from the latter point. For guns unprovided with azimuth circles, a temporary azimuth circle must be improvised. The board is simple to operate, portable, and can be installed in any station or at the guns.

[A Horizontal Base Spotting Board. By Lieut. L. A. McLaughlin, C.A.C. *Jour. U. S. Artill.*, Nov-Dec, '16. 400 words. Illus.]

This is a device for determining from angular observations made at the secondary station, the number of yards a shot strikes over or short. The board is installed in a corner of the plotting room, and the operator is in direct telephonic communication with an observer at the secondary station. The latter is equipped with a telescopic sight and reads the angular deviation of the splash as seen from the secondary station, which the board converts into yards. The results obtained will be accurate except when there is also a large deflection error.

—Range Finding—Time-Range Ruler

[Description of Time-Range Relation Ruler to T-Square. Developed by Corp. C. F. Houghton, 2nd Co., C.A.C., N.G.S.M. *Jour. U. S. Artill.*, May-June, '16. 300 words. Illus.]

This article describes the construction and operation of a light T-square and ruler, intended as a substitute for the heavy T-square now used on the standard time-range board. The advantages claimed for this ruler are:

Time-range curve is plotted more quickly, easily, and accurately.

The same ruler is used in plotting curve and in determining the range.

[A Modified Time-Range Board. Devised by Capt. Clifford Jones, C.A.C. *Jour. U. S. Artill.*, Sept-Oct, '16. 1200 words. 3 figs.]

The essential modifications of this board from the standard time-range board are as follows:

(a) The board is made smaller, 4' x 6½', and is installed in the plotting room.

(b) Only thirty-second time lines are drawn. The range lines passing thru zero, and the time line one minute from the right edge of the board are in red.

(c) An additional time scale is placed above the T-square.

(d) The T-square is supported on casters running on the top edge of the board, and the leg is beveled about two-thirds of the width to a thin edge at the right. The hundreds of yards are stenciled on the leg and the thousands written on the head. There is no sliding pointer.

(e) The time interval bell is arranged to strike one stroke at ten seconds, two at twenty seconds, and three at thirty seconds of each thirty second interval.

Two men, Nos. 8 and 9, are added to the range section. No. 8 plots the corrected ranges as received from the range-correction board and keeps track of the time. No. 9 transmits the deflection to the guns as announced, and upon hearing the command "Trip," repeated over the telephone from the gun, reads and transmits the range to the gun.

The advantages are: greater accuracy and simplicity in operation, the plotter can give information as to the movements of the target, and errors by the range section are apparent to the plotter.

COAST ARTILLERY—Continued

[The Plotting-Room Time-Range Board. By Capt. H. W. Bunn, C.A.C. *Jour. U. S. Artill.*, Nov-Dec, '16. 1000 words.]

The board consists of a piece of cross section paper, 30x40 in., mounted on a suitable drawing board or table, and is kept in the plotting room in lieu of the large time-range board in the gun emplacement. The operator is in direct telephonic communication with the range recorders at the guns. Immediately after the corrected range is determined he furnishes the gun with ranges for each ten second interval of the next observing interval of thirty seconds.

[A Time-Range Board for Guns. By Lieut.-Col. Robert E. Callan (C.A.C.), General Staff Corps. *Jour. U. S. Artill.*, July-Aug, '17. 1600 words.]

(The description of a time-range board and its operation. This board is different from the time-range board now in use in that it shows true range as an ordinate. It shows also from each last plotted point as an origin, a fairly accurate curve on which to base the elevation data. The ordinates show at any instant how the predictions have varied from the plotting board ranges.)

—Tactics

[Give all Base Lines to the Fire Commander. By Col. Henry C. Davis, C.A.C. *Jour. U. S. Artill.*, July-Aug, '16. 2000 words.]

In the present division of work and responsibility under our fire control system, the fire commander has a base line, and each battery commander has at least one for his battery. Under certain local conditions or in emergencies, the battery commander may need more than one base line. There are many instances, where different batteries cover all or a large part of the same wide field of fire, and where local conditions require a large installation of observing instruments and stations for any one battery to cover the field of fire satisfactorily; which installation must be duplicated for each battery, or an arrangement made by which any of the base lines and stations may be made available for any of the batteries.

Putting all base lines in the hands of the fire commander has many advantages. It saves time in assigning targets to the batteries for, instead of putting his own base line on the target and then indicating the same target to a battery commander who puts his base line on it, the fire commander assigns the target to a base line and then assigns the same base line which already is tracking the target to one of the batteries. Base lines not assigned to batteries in action can be tracking other targets and save time in changing the fire to another target. If one base line covers a given area, several batteries may be put on this area by assigning all to the one base line.

If one or more of the stations of a battery be disabled, instead of using an emergency system, the battery may be transferred to some other base line.

The fire commander in this way has better control over his command and the strain of the position finding is removed from the battery commander.

A change in organization will be called for, but this can be effected easily by transferring all personnel of the stations to the fire commander's detail. This will tend to systematize instruction and give better opportunity for developing teamwork.

—Target Practice

[A Reminder List for Battery Officers. Issued by the Dept. of Artillery and Land Defense, Coast Artillery School. *Jour. U. S. Artill.*, May-June, '16. 1200 words.]

(This article does not admit of digesting satisfactorily. It consists of a collection of hints for battery officers in the form of questions on the tests and adjustments required to be made of the guns, carriages, and accessories of the battery, before beginning target practice.)

[Additional Practices in the Coast Defenses of Pensacola. From a report by Lieut.-Col. W. C. Davis, C.A.C. *Jour. U. S. Artill.*, July-Aug, '16. 9500 words. 1 fig.]

Two novel features were included in the additional practices in the Coast Defenses of Pensacola during 1916, one being the firing by Battery Worth (12-inch B. L. M.) at land targets, and the other, a test in readiness at Battery Payne (3-inch B. L. R.).

The target for the land firing of the mortars consisted of hasty entrenchments and gun pits constructed on Santa Rosa Island, about three miles east of the battery. They were concealed by brush from all stations at the battery. The battery was assisted in finding the range and in observing fire by a naval airplane, which observed the fall of the shot and signalled the deviations by smoke signals from the exhaust, using International Morse Code.

The ammunition allowed for this practice was six cast iron shot and ten 1000 pound torpedo shell filled with 122 pounds of trotol each.

No satisfactory observation of the point of impact of the cast iron shot on land was possible from the airplane. They disappeared in marshy ground without appreciably disturbing the earth. The trotol shell functioned well and made a crater easily observed.

The following conclusions from the above firing seem to be justified:

(a) The necessity for an aviation section attached to each important coast defense, for scouting and for observing fire, especially against land targets.

(b) The detonation of the 12-inch torpedo shell probably would result fatally to all personnel within fifteen feet, due to shock alone, and serious damage to matériel within ten or twelve feet. Therefore effective use of this shell against land targets would require a large allowance of ammunition and an effective system of observation of fire.

For the test in readiness at Battery Payne, all boats went out about 10 p. m. the night before, for night exercises and to remain out all night. One boat, unobserved by the battery, took out a rapid fire target alongside. At daybreak the boat started in towing its target. The company manning this battery was in camp and in bed, except the usual watching details in

the stations. At 5:30 a. m., the field of fire was declared clear and "Call to arms" sounded. The battery was manned, the target assigned, and the first shot fired at 5:41 a. m.

COAST DEFENSE

See also

COAST ARTILLERY

GERMANY—COAST DEFENSE

UNITED STATES—COAST DEFENSE

[Coast Defense Studies, VI., Harbor Defense. By L. J. Cordeiro, Capt. of Artillery. *Revista de Artilharia*, Sept-Oct, '16. 3300 words. To be continued.]

(An elementary study of harbor defense, treating in this number of the use of aeroplanes and searchlights, with quotations and references to articles already published in the *Journal of the United States Artillery.*)

Spain

[One Aspect of the National Defense. Advanced Naval Base. By Major Juan Mateo Y Pérez De Ajejo. *Mem. de Infantería* (Spain), Oct '16. 5000 words.]

Spain's greatest weakness lies in her extended coast line, near which are located some of her most prosperous and populous cities. The defense of this maritime frontier cannot be insured by shore batteries and troops, but must be made on the sea by mobile squadrons. A powerful navy would not only be the best defense, but would also be the most important factor in developing the national prosperity and greatness.

Spain occupies, geographically, a very important strategic position in the modern world. The Iberian peninsula is the most advanced outpost of Europe toward America and lies on the flank of a defile thru which passes the great maritime highway connecting the east and west. These considerations continue to make alliance with Spain much sought after by the great states, tho her colonial disasters have exhausted her military and economic forces.

It is difficult to decide which part of the coast should receive first consideration; it is necessary at all cost to protect established interests on the Mediterranean and to insure freedom of action for our navy in that sea; but the north and northwest coasts are the most vulnerable, and there are many objectives located there to tempt foreign cupidity. Here we have only the naval base at Ferrol, and, altho it is admirably located for operations conducted either in the Atlantic or Cantabria, it is lacking in many elements of security necessary for such an important post.

An unsurpassed location for a naval base is at Vigo, which, in addition to its extensive harbor, could be easily prepared for defense by fortifying the outlying islands (Cies) and thus making it impossible to reach the ships or arsenals by direct or indirect fire. On the southern and eastern coasts are Cadiz and Cartagena, whose importance is recognized by all.

But these bases alone are not sufficient. Secondary bases are needed to support the operations of distant squadrons, and in the case of the Mediterranean, so located as to threaten all possible lines of operation against the Spanish coast. These conditions would be well fulfilled by a base located in the Balearic Islands; these islands, approximately 100 miles from our coast, lie on the line of communication between France and Algiers and close to the course which must be followed by all vessels crossing from the straits of Messina to Gibraltar; their strategic position has long been recognized, and the port of Mahon (on Minorca) is acknowledged to be the most secure refuge in the Mediterranean. The value of these islands depends upon command of the sea, but this we must have, either alone or with the aid of allies.

It is generally believed that Mahon has not sufficient depth for modern armored vessels, but this could be corrected by dredging and at relatively little cost. It is also contended by some whose opinions merit consideration that the experience of our fleet at Santiago and of the Russians at Port Arthur condemn all ports such as Mahon, with narrow and tortuous entrances, and these persons would favor the establishment of a base at Polienza (on Mallorca), with its ample anchorage and wide entrance.

Even if the conclusions as to the best type of port were correct, there are still many reasons which point to Mahon as the logical base. If, at the worst, it became necessary to abandon the islands temporarily to their own defense, Mahon would be much more difficult to capture than any other port in the islands. Impregnable to attack from the sea, the enemy would be compelled to resort to land operations, and the experience of the English in 1798 and the Spaniards in 1781 prove how difficult such operations would be, owing to the rugged nature of the coast line, the shallowness of the water, and the lack of all facilities for landing troops.

The small size of the island would also be an advantage, requiring fewer troops for its defense. A mobile force, centrally located, as at Mercadal, could easily reach any threatened point in time to oppose any attempted landing.

There is but one point, Fornells, offering even fair conditions for landing an expedition, and this should be prepared by fixed defenses in advance.

The immediate defense of Mahon on the sea front should be in line with the recommendations of Captain de Cienfuegos, who has made a thoro and detailed study of the situation.

(Here follows a projected scheme, giving strength and location of batteries to be established about Mahon.)

—Against Land Attack

[The Employment of Heavy Sea Coast Artillery Against Objects on Land. *Svensk Kustartilleritidskrift*, Part 3, '16. By P. A. I. 2050 words and 1 table.]

The important rôle played by the artillery, especially by the heavy artillery, in the present world war is a universally acknowledged fact. At Liège and Namur the forts were comparatively easily captured by the attacking infantry columns after the heavy guns with overpowering force had cleared the way. In field and position warfare, the infantry cannot win a position until the enemy's curtain fire has been silenced and

COAST DEFENSE—Continued

their own "drum fire" has cleared away the obstacles and caused the defenders to waver. If we compare these experiences with the views, again established by the failure of the attack on the Dardanelles forts, that a fleet cannot alone subdue a coast fortress, but also requires the assistance of land forces, it appears self-evident that no means should be omitted to guard the most vulnerable side of the fortress—the land front.

A considerable increase of defensive power would be gained if to the seacoast artillery, without interfering with its principal functions, were given the possibility to take part in the land defense. Since the range-and-position-finding systems used for locating objects on the water, by the coast batteries, are not suitable for locating objects on land, other means must be devised to attain this object. For this purpose, a topographic map, on a scale of about 1:2000, is recommended, in which all the important points that an enemy might occupy are accurately located as well as the position of the different batteries. This map should be divided into squares by lines parallel to the top and sides, and the division on the sides and top and bottom lettered, so that each square can be located by means of two of these reference letters. If more definite location of an object is desired, its position in a particular square can be designated by some adopted very simple plan involving but one or two extra words or numbers in sending.

The scouts are to determine the position of the enemy, with reference to the map, and report their observations to the commanding officer, who supplies this information to the batteries that he designates to fire. Scouts are also to observe and report the effects of the firing, that is, where the shots actually strike, with respect to the enemy's position.

Since an enemy's position can be more readily observed from an airship, this new means of reconnaissance and observation is now widely used. [The author quotes in this connection parts of the article on "Artillery and Aircraft" in *Artilleri Tidskrift*, 1916. See pp. 562-3, *International Military Digest*, December, 1916.]

The coast fortifications should be provided for this purpose with suitable airplanes manned by skillful and experienced observers, preferably artillery officers, and with suitable means of sending the information obtained to the batteries. Suitable ammunition should also be provided for firing at objects on land, since armor-piercing projectiles are not suitable for this purpose. The projectiles should consist of percussion shell and shrapnel. According to reports from the United States, the mortars mounted at the ends of the Panama Canal are being provided with such ammunition, so that they can also be used in firing toward the land side. It has been found by experiment that more sensitive percussion fuses are required for firing against objects on land than those used against armored ships, as the projectiles will otherwise bury themselves too deep in the earth before exploding.

It has been found difficult to devise reliable time fuses, since, owing to the great height to which the mortar, or howitzer, projectiles rise in their flight, the air pressure varies greatly and hence the time of burning varies. It is said that Krupp has devised mechanical time fuses that are more reliable even for high trajectories.

—Against Naval Attack

[Organization and Tactics of Coast Artillery Gun Defense. By Capt. James A. Thomas, C.A.C. *Jour. U. S. Artill.*, July-Aug, '16. 15,000 words.]

"Tactics is the art of disposing and maneuvering troops on the field of battle"—Wagner. This definition, tho true, is incomplete since fire discipline, fire control, and fire direction, occupy an important place in General Wagner's work on Organization and Tactics. If these subjects are so necessary in the tactics of mobile troops, how much more necessary are they in the tactics of coast artillery, which depends upon fire action alone for its potency.

Battle tactics of coast artillery treat of the fire action of all classes of armament during an engagement, and include a knowledge of the types of guns and carriages, their uses, limitations, and powers; their purposes and characteristics; the parts they are created to perform, and how best to use them.

Each commander must be thoroly familiar with all classes of armament, that he may be prepared to render prompt co-operation in an emergency. Battle tactics change constantly with every improvement in means of offense and defense, and is a live subject always.

Coast artillery troops are charged with the preservation, maintenance, and operation of the coast defenses in time of peace, and with their efficient service in time of war. For the performance of these duties, organization is necessary, and we have for administrative purposes, the company, fort (post), and coast defense units; and for tactical purposes, the battery, fire (mine), fort, and coast defense units.

At one time a unit in the tactical chain of command (the battle command), intermediate between the coast defense and fire commands, was deemed necessary, its functions being to co-ordinate all armament covering the same or contiguous water areas. This unit has been displaced by the present fort command, which gives rise to some anomalous situations in the tactical chain of command. Therefore a new unit or really a revival of the old one, is suggested, called the fortress command. Such a commander is a tactical commander only.

It might appear that the above double unit system is conflicting and operates against efficiency, but the contrary is true.

The number of troops assigned to the defenses in time of peace is but a small percentage of those actually required in time of war. It is not always possible at any fort to have a complete tactical unit larger than a battery. Efficiency of instruction is best attained by organizing complete battery or mine units which are not dependent upon the presence of other battery units for drill, instruction, or service of the battery. These

battery units make excellent company units as well. Coast artillery are armed, equipped, and drilled as infantry, and the administrative units of the company, fort, and coast defense, correspond to and may be readily converted into companies, battalions, and regiments in the infantry organization.

The basic tactical unit in the coast artillery is the battery. It must conform to requirements similar to those for other forces and varies with the caliber and type of the weapon. The battery is composed of a range section; and for each gun, an ammunition and a gun section. It comprises the largest number of men which can be directly commanded in action by a single individual, and it contains within itself all the elements, and no others, necessary to enter and sustain independently an action.

Batteries which have common or contiguous fields of fire, are grouped together into fire commands, for the purpose of controlling the rate, dispersion, or concentration of fire, and expenditure of ammunition. Experience has demonstrated that four batteries are the maximum that can be controlled efficiently by one fire commander. This also is a desirable strength from a tactical standpoint, since the naval division consists of four ships of the same type or class,, and a fire command thus may easily be dispersed over all ships of a division. Mortars form separate fire commands. The mines, together with the rapid fire guns covering the mine fields, form the mine command.

To secure a combination and co-operation of the fire commands, they should be grouped together into fortress commands. If the entire area covered by the fire of a single coast defense command can be observed from a single station, but one fortress command is organized, otherwise as many as are necessary to observe the entire battle area. Fire and mine commands are grouped into fortress commands without regard to class and caliber of armament.

The functions of the fortress commander are to estimate the situation, to decide upon and put into operation a plan of action to defeat the intentions of the enemy. He observes the effect of the fire, changes the targets of fire commands, and designates the moments at which the action shall begin and end.

Coast defense commands are established and their limits fixed by the War Department. The duties of the coast defense commander are of a general and supervisory nature, and he exercises authority over all forces in his command. He has no separate place or necessity in the artillery chain of command.

Coast artillery is pre-eminently the defensive branch of the miliary establishment. It cannot initiate an action, but must wait for the enemy to attack. It cannot change formation or maneuver for advantageous position; nor can it follow up and destroy a defeated enemy. It has many advantages due to its immobility, in the great weight and power of its guns, great protection, the use of high angles of elevation, and the employment of long base lines insuring great accuracy of range finding.

For tactical purposes, armament may be classified into primary, intermediate, and secondary. The primary armament is of first importance, and includes the largest guns and mortars. The mortars are the complement of the guns in attacks upon naval vessels of the first class. At long ranges, the penetrating power of the mortar is greatest and that of the gun the least; while at short ranges the reverse is true.

General Naval Conditions

Naval operations, other than raids, against the coast defenses of a country, presuppose naval superiority or command of the sea by the attacker. Such operations may include one or more of the following:

Blockade.
Reconnaissance.
Demonstration.
Raid.
Bombardment.
Run-by.

Blockade is the interruption of communication by sea with a part or all of an enemy's coast. There may be either commercial or war blockades, only the latter being necessarily a cause for war.

No matter how complete and detailed may be the information with which a naval commander is supplied when operations are projected, it must be verified and brought up to date by reconnaissance. The information usually desired is the location of batteries, searchlights, stations, and mine fields, arcs of fire, range, and dead angles of batteries, landing places for troops, and to locate and chart landmarks for aiming points and compass courses.

Reconnaissances may be made by day or night, at close or long range, and may be preliminary or in force. The latter are made when the coast defense commander will not disclose information in any other way. Reconnaissances usually begin at long range, with the hope of getting the desired information at small cost.

A demonstration has for its objects, to harass and wear out the garrison, to force expenditure of ammunition, or to cover some other operation.

Raids are attacks upon more or less exposed elements of the defenses, such as mine fields, obstructions, stations, searchlights, and detached batteries.

A bombardment is an attack upon the fortifications with intent to destroy or seriously cripple them, with a view to a run-by, wherein the fleet or a part of it, forces its way past the fortifications and attacks the city, naval base, or fleet, they protect.

Battle Tactics

The tactical grouping of armament is made to obtain its most prompt and powerful destructive effect in action. Tactical control begins with the fortress commander, and extends down thru fire and battery commanders to the individuals. It depends to a large extent upon efficiency of communications, which fact is recognized by making the battery the basic tactical unit and providing a general defense plan for use when communications fail.

The following may be assumed as the logical sequence of naval operations:

COAST DEFENSE—Continued

1. Establishment and occupation of the base.
2. Establishment of the blockade.
3. Reconnaissances.
4. Demonstrations and raids.
5. Bombardments.
6. Run-by.

The employment of the armament in defense against all forms of attack will depend upon many conditions, one of the chief being the state of the ammunition supply and the possibility of replenishing it.

The fortress commander must be able to analyze quickly and accurately the intentions of the fleet commander, and must employ all the force necessary to defeat them, keeping the fleet at a respectful distance with his mortars, and disclosing the least possible information consistent with defeating the enemy's intentions. Unless he has an ample ammunition supply, he must conserve his ammunition and make each shot count. He must be able to determine quickly which is the main effort of the hostile fleet and concentrate all necessary armament upon it. He must know the power of his armament and the general character of the ships he is attacking in order to assign his armament most usefully.

An organization into reliefs should be perfected so that the garrison may get proper rest, by calling to the guns only such part as is necessary to defeat the immediate attack. The naval commander will risk damage to his vessels only commensurate with the object to be obtained. If conditions warrant a run-by we may expect to see them made in the future as in the past

There are two general methods by which battle control may be exercised:

The general defense plan.

Individual control.

The general defense plan seems simple, and is easily and quickly put into operation. It is well thought out long in advance, and carries written instructions. But it is difficult to decide in advance just what the enemy will do, so altho the general defense plan is valuable and important, it can be considered only as subsidiary to individual control, which is the proper and correct way to exercise battle tactics. The fortress commander estimates the situation, decides upon the intentions of the enemy, and gives appropriate orders to the fire commanders, and during the course of the action, gives such additional orders as the changes in the situation warrant.

—By Mines

[Cleaning Mine Cases. A Method Employed at the Coast Artillery School. By 2d Lieut. C. B. Lindner, C.A.C. *Jour. U. S. Artill.*, Sept-Oct, '16. 300 words. Illus.]

The following method was used for removing rust from the interiors of mine cases:

An inch-and-a-half shaft, one foot long, was put into a mine plug proper. Two cable reel jacks were bolted to the wharf the proper distance apart and convenient to the derrick. To one jack was bolted a board with a U-shaped groove cut in it, in which the maneuvering ring of the mine cases was to rest while the case was being revolved. The other jack was arranged to hold the shaft and could be screwed up and down.

About 150 lbs. of large gravel was put into the case to be cleaned, the plug screwed in, and the case put upon the two jacks, supported by the maneuvering ring and the shaft as above indicated. The case was then revolved by a belt driven by an electric motor, the plug end being raised and lowered during rotation in order to have the gravel work thruout the whole length of the mine case. From ten to twenty minutes sufficed to clean out all rust. After emptying out the gravel, the interior of the cases was coated with tar-oil before being put back in storage.

[Mine Efficiency from Storehouse to Dock. By Lieuts. C. R. Snow and H. G. Douglas, C.A.C. *Jour. U. S. Artill.*, Nov-Dec, '16. 2500 words. Illus.]

From storehouse to dock the efficiency of a mine command will be measured by the direct ratio of the rapid and sustained delivery of complete mine groups, properly assembled, to the manual effort required. Under service conditions, the rapid completion of a project without undue physical and nervous strain on the personnel of the mine command is vital. Efficiency is dependent upon the two main phases of the mine work, viz., the delivery of the assembled material to the planter at the dock; and the placing of the loaded mines in position.

Only the first phase is considered in the plan herein suggested.

The mine structures should be so arranged that material can be taken from "in store" and delivered to the mine planter ready for planting by the fewest men. In the arrangement suggested by this article, it is sought to afford a continuous car service by having cars move in one direction, with a direct track from the buildings to the dock and a return loop for empties; and to handle all elements the minimum number of times.

The wharf is arranged so that loading can be carried on simultaneously at both ends of the planter. Separate tracks run from cable tank and anchor platform to dock. A parade, with measured distances marked out on it for measuring cable and rope, adjoins the cable tank and small stores house. Mines are loaded on a special car holding six in the loading position. They are loaded, the compound plugs are inserted, and the caps are put on without unloading mine cases from the car.

—By Mobile Guns

[A Study on the Use in Land Defense of Heavy Mobile Artillery. *Jour. U. S. Artill.*, May-June, '16. 1600 words.]

The general arguments for introducing heavy transportable artillery into the system of coast defense are:

(a) Extension of coast defense to points not now covered.

(b) Concentration at threatened points.

(c) Greater defensive power at less cost.

(d) Attack delivered from places not marked out by the enemy in time of peace.

(e) Employment in land as well as sea defense.

(f) Strengthens existing coast defenses.

(g) Tactical flexibility.

A study of railroad and road facilities at hand for the employment of such artillery, shows our most important strategical areas to be well supplied with railroads and roads.

It is suggested that the present tactical units, known as coast defenses be enlarged to cover the entire coast line; that the number of coast artillery districts be increased to eight; and that the proposed rail batteries be placed at the disposal of district commanders.

The following mobile armament is proposed:

Rail batteries of two 16-inch mortars or two 14-inch guns each to constitute an armed and armored train.

Road batteries of two 11-inch or 12-inch mortars each, or two 6-inch guns each; or two 6-inch howitzers each, or of 3-inch anti-aircraft guns.

The road batteries are to be transported by or mounted on motor trucks of appropriate design.

A table gives the distribution of this armament among the existing coast defenses.

As appendices are given the details of cars, costs, weights, and lists of equipment of these batteries.

[An Army Railroad Howitzer. *Scientific American*, Dec 23, '16. 800 words. Illustrated.]

Altho our important ports are protected by fortifications, long stretches of our seacoast are undefended. The European War has demonstrated the possibliity of mounting heavy guns on special railroad cars. Two illustrations are given of a car for 4.7-inch howitzer. The gun is mounted on a turn-table in the center of the car, with an all-round arc of fire. Four heavy brackets are hinged to the sides of the car. These can be swung outboard and used by means of baseplates and screwjacks to support the car laterally and take the shock of discharge. Lateral shields pierced with ports for rifle and machine gun fire are provided.

[Heavy Mobile Artillery for the Coast Artillery. By First Lieut. Meade Wildrick, Coast Artillery, U. S. Army. *Svensk Kustartilleritidskrift*, Part 3, '16.]

[Heavy Mobile Artillery. Its Value as an Asset for Defense in the United States. By Major C. E. Kilbourne, General Staff Corps, U. S. Army. *Scientific American*, Mar 3, '17. 2700 words. Illus.]

In order that an enemy who has gained control of the sea may not land a force at an unprotected harbor or upon an open beach, the United States needs artillery fulfilling the following requirements: First, great mobility; second, prompt entry into action upon arrival within range of the enemy's vessels; third, rapid change of position in event of fire from the attacking vessels becoming so accurate as to threaten destruction; fourth, sufficient power to destroy a warship by a single hit if the vital part of the vessel be struck; fifth, a means of range finding which insures to the gun the advantages of permament employment and installation. The gun carriage must be an integral part of the railroad car and must permit of being secured by simple operations (not requiring more than two or three minutes) to a base so solid that the gun, after firing, will return to the same position, thus avoiding delays between shots.

On both our eastern and western coasts, thruout the more important strategic areas, railroad lines parallel the coast at a short distance inland, making convenient the rapid transportation of such ordnance from place to place at positions fixed in advance, the location of observing stations for the accurate control of fire may be determined and a plotting board prepared so that the gun may open accurate fire immediately on getting into action. The gun must begin to make hits before the battleship can determine its range accurately and deliver return fire. To hit first in artillery combat usually means to win.

In permanent fortifications which protect cities, navy yards, etc., guns and mortars of 16-inch caliber are necessary to keep the enemy's ships beyond extreme range. But for the open beaches and harbors of minor importance, the 12-inch gun and the 12-inch mortar, already developed and tested for our seacoast service, are believed sufficiently powerful for our mobile armament. The weapons, when used together, have an effect destructive to the average warship at all ranges up to nine miles.

A railroad unit should consist of a 12-inch gun on one car, two 12-inch mortars on another, four antiaircraft guns on a third, an ammunition car for the gun and one for the mortars, a car for the range-finding equipment and the necessary cars for the personnel.

If this country had a large number of movable guns and mortars, no enemy could count on unresisted landing at any point on our coast line. No nation attacks another without first making plans promising a successful outcome of the venture. Anything tending to render success doubtful will operate to complicate the plan and possibly to prevent the attack entirely. The writer knows of no single preparation which will so strengthen our defensive powers as the provision of powerful, long range, movable artillery.

[Mobile Armament for Defense. By Mr. Andrew M. Coyle, M.E. *Jour. U. S. Artill.*, July-Aug, '17. 8000 words. Illustrated.]

The prospect of valuable development of mobile artillery for coast defense is particularly good in this country because, starting with a clear field, we are not bound by types which, constructed under emergency, have to some extent become fixed in the armament of other countries.

This article points out briefly with the aid of illustrations the general features of the several types of mobile armament which have been developed in Europe, and also explains the simple mechanics involved in the problem presented.

COAST DEFENSE—Continued

Next to the development of the armament itself is the development of railroad and roadways paralleling the coast lines. At present we have trunk lines parallel to our eastern coast. Branch roads could be constructed and operated with profit. Every railroad and road constructed in this scheme of defense would be of great commercial value in time of peace.

The following remarks of the author upon the various types of armament are of interest.

Armored and Armed Automobiles

The armament is necessarily light, about one pounder. The shields protect only the gunners and not the working parts of the machine. The advance of these machines may be stopped by concentrated fire on the running gear. Because of excessive weight it is impossible to armor automobiles against anything heavier than a rifle bullet.

French Skid-Mounted Howitzer

This howitzer is not fired from the truck but is skidded off when put in action. This operation requires about the time necessary for unlimbering regular artillery. The howitzer may be fired from all positions, from the trenches and from behind low breastworks. When the howitzer is in action the motor-drawn truck is withdrawn out of range.

Non-Recoil Davis Gun

Used on aircraft to some extent because it is the only gun which will fire a moderately heavy projectile without heavy recoil. A shot is fired from both ends, the forward projectile being shrapnel and the rear one a substance which immediately breaks up into small fragments. In practice a mixture of birdshot and vaseline is used. This gun sacrifices efficiency and convenience.

Tanks

The weight of these machines is so enormous that they will crush in anything but the most substantial ground. A direct blow from a 15-pound projectile will put the tank out of commission. As the progress of these machines is slow, they can be stopped by guns of sufficient size before they have gone very far.

Armored Railway Cars

The first armored railway car ever used in warfare was constructed in this country under the orders of Gen. Robert E. Lee, who saw at an early stage of the Civil War the value of this equipment.

The locomotive is the vulnerable part of an armored train. For this reason each car should have independent motive power. Also the airbrakes, journal boxes, truck frames, etc., must be protected from rifle bullets.

Heavy Railway Artillery

The maximum force applied transversely which a railroad track will resist equals about 30 per cent of the load on the track. As the tendency is to lift the car when the gun is fired horizontally, the full weight of the car cannot be considered in making allowance for the resistance of the track.

Some cars on which guns are mounted have a system of outriggers, which are steel arms extending from the sides of the car. These arms are supported on a firm foundation, usually by struts or jack-screws. The outriggers form a broad steady platform.

Some of the heaviest railway guns are fired from previously determined and carefully prepared foundations. Others are fired from cars moving on a curved track. The gun has a slight traverse on the car, but the main traverse in azimuth is secured by moving the car on the track. When the gun is fired the car recoils along the track. This is objectionable because the gun has to be re-aimed after each shot, thereby losing the advantage of a good shot.

The first gun mounted on a railway truck was an old-time mortar mounted by the First Connecticut Artillery during the Civil War. Five shots were fired before the truck collapsed.

Heavy Howitzers

The large howitzer used by the Germans at the outset of the war in Belgium is not a mobile weapon. It must be fired from a previously prepared foundation of concrete, or of heavy timber bedded in clay, sand or cement. These guns are transported either assembled or in parts upon flat cars. The parts are handled by wrecking cranes.

New Type of Coast Gun

The peculiarities of a new type of seacoast gun and mortar are that the breech-block does not screw into the breech, and that the piece does not recoil. The breech-block is a simple plug provided with a gas check. This block abuts upon a hardened steel surface which is curved, the curve being concentric with the trunnions of the gun. The reaction at the time of explosion acts as a static load upon the abutment. There is no mass in motion. The abutment member is traversed in azimuth in a casting which is a spherical segment. The concrete foundation must be sufficiently massive to stand the static load imposed. In the case of a 12-inch mortar this would be about two thousand tons. The gun does not disappear but the splinter-proof housing is small and inconspicuous and may be concealed from the enemy until he is within close range.

—Fortifications

See
FORTIFICATIONS — PERMANENT — FOR COAST DEFENSE

—Troops—Supply and Transport for

[Preparations That Should Be Made in Peace for Quartering and Provisioning Coast Defense Garrisons in War. By Capt. H. C. Barnes, C. A. C. *Jour. U. S. Artill.*, May-June, '16. 3200 words.]

During his work in charge of Coast Artillery War Game instruction, the author was much impressed, thru the many discussions that took place, with the large number of details for which no detailed plans ever have been prepared. The subject of this paper is only one of a number of matters which must of necessity be left for action until the outbreak of

hostilities. There are so many of these that it would seem a matter of vital importance that detailed plans be prepared in time of peace to ensure proper execution when the time arrives.

The projects for land defense of our fortifications by the coast artillery supports include projects for camps for the war garrisons. These projects are general in character, and coast defense commanders are charged with their execution and are directed to have ready at all times detailed plans for doing the work with available men and materials. If coast defense commanders have complied with these directions, there should be some kind of detailed plan at each coast defense command headquarters.

One needs but to see the amount of work involved in preparing these plans to realize the almost insurmountable difficulties in solving satisfactorily the problems of planning this work at the outbreak of war. The problem of quartering and provisioning the many detachments necessary to man the various elements of the armament is a local problem and each problem should be considered carefully in time of peace and the plans should be kept up to date.

As a means to this end, it is suggested as part of the post graduate course, that a problem be given out to the officers taking that course, under which will be taken up a study of the plans for provisioning and quartering the war garrison. This article suggests methods of stating such a problem.

—Use of Aircraft in

See also

United States—Coast defense—Use of aircraft in

[Effects of the Appearance of the Submarine and Aircraft on Coast Defense. By Pedro Jevenois, Captain of Artillery. *Memorial de Artillería,* Dec, '16. 8600 words.]

Military history teaches that the appearance of new arms always exercises great influence on the technique of national defense.

The protection of our [Spanish] coasts is a problem of primary interest, of capital importance and absolute necessity for the maintenance of our independence as a nation. The Pyrennees form a very strong natural frontier, almost invulnerable, even if defended with a reduced army. Our Portuguese frontier, besides separating us from a friendly and weaker nation, is also easy to defend. Our only weak points are the coasts and the defense of the freedom of the Straits of Gibraltar which has been imposed upon us on account of our geographical situation and our position as a Mediterranean power. Spain being so much interested in coast defense, we must examine most carefully into the future influences of the submarine and aircraft on the ideas heretofore held on this subject.

Up to the present time, war has been conducted for the control of the land and the surface of the sea. To-day the fight is for the command of the air and under-water supremacy. Our lack of imperialistic spirit precludes our thinking of dominating all the seas and all the air, but the indispensable measures necessary for our security require, that we dominate in the vicinity of our coasts, the land, the navigable waters, and the air. Our coast batteries are designed only to protect our fortified harbors and naval bases from the fire of ships which navigate the surface of the sea. It is clear that submarines and aircraft require modifications in this defense and it is these which we have to study.

Strategically, the submarine exercises more influence on coast defense than aircraft. It has simplified and made more economical the defense of the coasts; it has permitted a more efficient defense; it has permitted that within our resources we may be able to count on a considerable element of offensive and defensive force. Its appearance has been a benefit for Spain and the weaker nations. It must not, however, be overrated, for the appearance of each arm has always been followed by protection against it. It is the same old fight between the gun or the torpedo against armor; of the offensive against the defensive; a fight which will end with the world and which has always been decided by the active element over the passive.

Aircraft will be used tactically against the coasts and in the dominion of tactics acquires a decisive importance in certain cases. Altho a very recent arm, its rapid progress as shown by its use in the present war, makes it possible to predict a great development in the future.

We will examine into the effects of these two arms with special reference to coast defense.

I.—Influence of the Submarine on Coast Defense

The activity of submarines in the present war has been more apparent in operations against an enemy's commerce than in truly military missions. In the fleet actions which have taken place, we lack details of operations of submarines; in coast defense operations it has, however, played a most important rôle.

One would be bold to award to the German submarines the credit for the fact that not one single town of the Baltic or North Sea coasts has been attacked by the British fleet, altho that fleet is in almost indisputable command of the sea. The configuration of the German coasts, the difficulties of navigation, increased by mine fields, would have been sufficient without submarines, to protect the coasts from attack.

Only Admiral Degouy in the *Revue des Deux Mondes* has considered feasible an attack in force with a disembarkation on the German coasts. With this exception it is the general belief that this coast, so rough and difficult of navigation and so well adapted to mining operations and defense, may be considered invulnerable.

The action of the Russian submarines against German operations in the Gulf of Riga give a better argument for the use of submarines in coast defense, but even here the details are so little known that is impossible to base any fundamental theory upon them.

More convincing are the operations of submarines in the Dardanelles and Adriatic. The appearance of

COAST DEFENSE—Continued

the German submarines in the Sea of Marmora at once relieved the pressure of the *Queen Elizabeth* and other large armored ships on the Turkish coast batteries. In the Adriatic the presence of submarines has made difficult the bombardment of the Austrian coast, notwithstanding the command of those waters by the Italian fleet; and defensively, they have enabled the guns of Pola or Cattaro to remain silent, for this last named port was only weakly attacked.

It is evident that the British fleet has found means to protect a small zone against submarine attack. We do not know the complete details of the means adopted, but they must be effective when we take into account the great movement of troops and supplies across the Channel, to Salonika, the Dardanelles, etc.

In coast defense operations the mine and submarine, combined with the gun, constitute a great defensive arm and it appears that they have not only been able to keep the great enemy fleets away from the coasts, but also to make nil the action of submarines. No large ships will be so bold as to attempt to cross an area during the night if submarines are present.

Our naval program contemplates the construction of 28 submarines whose characteristics have not been announced. We assume that, as Portugal has done and as the United States is doing, these will be divided into groups or classes as follows:

(1) Fleet submarines;
(2) Coast defense submarines;
(3) Harbor defense submarines.

Since Portugal has submarines, it may be assumed that whoever our enemy may be in the future, he will employ submarines against us and his action may be foreseen. With this end in view we will point out the characteristics of each class, for knowing them, we can study the best form of preparation against them.

(a) Fleet submarines. These have:

- (1) Great mobility and speed, extensive radius of action and large displacement.
- (2) Offensive armament, including rapid fire guns of 10 to 15 cm.
- (3) Rapid submersion.
- (4) Small target presented.

(b) Coast defense submarines. These have:

- (1) Limited radius of action, but great mobility.
- (2) Defensive armament of rapid fire guns of about 7.5 cm.
- (3) Extreme rapidity of submersion and emergence.
- (4) Slight visibility.

For this service old fleet submarines may be used.

(c) Harbor defense submarines.

These submarines form part of the local defense of harbors and naval bases and are designed to work in connection with the coast batteries. For this service, older models of coast defense submarines and submersibles of limited displacement may be used. Some of this type may be used as anchored or fixed submarine batteries and would be able to deny the water areas covered to any force of large ships which might wish to use it.

Having outlined the general characteristics of the submarines which may be used in the attack and defense of the coasts, we will examine into the most rational methods of using them. We will examine, first, what coast defense has to fear from the submarine, and afterwards what measures may be taken to oppose the submarine.

A hostile submarine may undertake military operations of great importance against the coasts. Its principal object will be the destruction of fleets which may have taken refuge in the harbors; the destruction of commercial shipping; the disabling of docks, wharves, and other harbor works; reconnaissance of the coast defenses; disabling of the mine fields; the bombardment of cities and open beaches or commercial establishments situated within range of the fire from ships, a situation which is not uncommon along our coasts.

In opposing operations of this class, the seacoast armament will have but small relative effect, as its mission will be limited to protect the devices which are designed to close the channel to submarines or to indicate their presence. The coast batteries will open a heavy fire on any submarine which is observed, as it will be compelled to come to the surface after striking the object which is designed to stop it.

As an offensive arm the submarine has a very limited action when used against coast defenses, in that it will be restricted to such dead angles to which it may come submerged without exposure to the fire of the defenses. This will require a modification of most of the defenses with the object of covering the dead angles from which the fire of a submarine may be delivered. The best method of covering these dead angles will be by means of mobile batteries mounted on railroad cars or automobile trucks. These may be sent quickly to any threatened point.

To oppose the offensive action of the submarine there are a large number of measures which have been adopted by the belligerents in the present war and which have rendered excellent service. We have seen that the Austrians in Pola and Cattaro have used metal nets and the Turks a similar system in the Dardanelles. In England they have laid nets sustained by buoys of a special type, which give off flame or smoke when the net is struck and the buoys are submerged, thus indicating the presence of the submarine. The destruction of the submarine is accomplished by gun fire when it comes to the surface to take air or to observe. Another type of net entangles the propeller and makes it necessary for the submarine to come to the surface.

There are, besides those mentioned above, a large number of means, now held secret, which facilitate the defense against submarines and the large number of submarines lost when attempting to force channels and harbor entrances, testify to the efficiency of these means.

The submarine does not in any way constitute a danger for the coast defenses, as may be deduced from the foregoing, except in the case of appearing in dead

angles. On the contrary, we see that as far as coast defense is concerned, the submarine has come to aid it and to solve a very important problem.

What aid may be expected by the coast defenses from the submarine?

We have noted that the appearance of the submarine will cause the modern and powerful warships of an enemy to keep some distance from the coast. It has therefore reduced the quality, the power and efficiency of the principal enemy of coast defense. This will not however, be the case when special types of vessels, such as monitors and older warships are used.

All of the coast defense systems of the world have matériel inferior to that of the more modern warships, not excepting the coast defenses of the United States which may be said to be in the best condition of all.

In actions with modern warships, coast defenses up to the present time have always been inferior in gun power. The appearance of the submarine will have the effect of reducing this difference in power without neutralizing it completely. The consequence of this will be that only in the case of an objective of primary importance, the possession of which is essential to the conduct of the war, will justify an enemy in exposing and using capital modern ships in operations against the coasts.

In the case of Spain, the only object which an enemy could have in view which would justify the use and exposure of costly modern ships, would be the forcing of a harbor in order to complete the destruction of a fleet which had taken refuge in it, the destruction of a fleet within a harbor by distant gun fire controlled by balloon observation, or the forcing of the Straits of Gibraltar. Even in this case the fire of the attacking fleet would be of short duration, for the fleet would not be able to remain near the land during the night.

From this conception it may be deduced that only in certain harbors will it be necessary to emplace heavy caliber guns. It will also be evident that, as the action will be of short duration, it will not be necessary to provide three reliefs for the service of the batteries, but that two will be sufficient. Both of these deductions are due to the appearance of the submarine.

With reference to the defense of the Straits of Gibraltar which is imposed on Spain by reason of her geographical situation, it is clear that the submarine will facilitate this mission in combination with a limited number of large caliber guns.

The submarine having limited the use of large caliber fixed guns to a few harbors, including naval bases and the Straits of Gibraltar, it may be stated that there will be developed on the other hand large and medium caliber mobile guns to defend places of refuge, the mine fields, and in combination with the latter, the undefended cities. The present war has shown clearly that international law is a myth and that an undefended city is a city open to bombardment and destruction.

Along the length of the peninsula and in some of our African possessions a system of submarine defenses will have to be established. The coast and harbor defense submarines will be based at certain points whose defense will be easy, combining a few coast batteries with the mine fields, which will be illuminated at night and provided with obstacles, all of which will have to be taken into account when selecting the stations.

From the gunnery point of view, it will be necessary to locate the guns so as to cover the mine fields from positions defiladed from view and fire from the sea, being exposed only to the fire of aircraft. A few batteries thus located will be able to accomplish their mission. The illumination of the mine fields and obstacles at night thus becomes a matter of great importance and must be well attended to. Small-caliber guns will also have application in some particular cases, but it is not seen how they may be utilized except against aircraft when the caliber is inferior to 10 cm.

If the hostile fleet concentrates in order to carry out a definite and concrete mission, as, for example, to "bottle up" our fleet in a given port, to close or force the Straits of Gibraltar, etc., it is necessary that the coast defenses or part of them be so arranged as to be able to concentrate at any threatened point, as the objective cannot always be foreseen.

We recall that when Cervera's fleet sailed for the West Indies it was obliged to seek refuge in the port of Santiago, whose military defense was practically nil, and there it was lost; while Havana and San Juan would have been able to protect it and to aid it almost indefinitely. If the greater part of the armament of the coast defenses of Havana could have been transported to Santiago, the conduct and development of the siege of that city would have taken on an entirely different character.

The combination of the use of submarines, protection of their bases and the necessity of concentrating them, makes at times the batteries which protect them appear useless, due to developments in the war. It is clear, then, that, concentrating the submarines, the guns which protect them must be able to concentrate. Extending even more the principle, if by reasons of our alliances or by disposition the war is a continental war, and it is not necessary to defend the coasts, would not the guns which protect the submarine bases play a more important rôle on the battlefield than if they remained inert, immovable and silent on their mounts?

It may be deduced from these conceptions that we must make our coast defense armament mobile and active, giving it elasticity. We will demonstrate later the development of this matériel. With the exception of the heavy-caliber guns of the naval bases (and these will be few in number), all coast defense armament should be mobile and capable of being transported wherever it may be needed.

For the direct protection will be substituted the concealment and change of position. Thus if the fleet takes refuge in one of our bays or ports, in it will be concentrated all of the defensive elements available and even more; the same gun which may be used against a battleship at Cadiz may be used in Jaca or in Choritquieta against an enemy on land.

COAST DEFENSE—Continued

We will study in another article the means which have been adopted with this end in view and the matériel which is in use in Europe to-day in the defense of the Belgian coast, at Verdun, in the defense of the Gulf of Riga and in the Carpathians.

The defense of the Belgian coast with improvised armament is a lesson for our authorities, for it may be observed that the great works of concrete, the massive turrets and parapets, except in the defense of important advanced points near naval bases, have passed into history.

The use of fleet submarines is a naval disposition exclusively. They will be used in combination only in defense of the coasts and naval bases. The organization of a system of radio stations and of aircraft reconnaissance will result in knowing in time the plans of the enemy and of foreseeing the point of disembarkation, giving time to concentrate the mobile columns charged with repulsing such operations.

The distribution and operations of coast defense submarines have such great importance that they may be combined with the defense provided for the naval bases. The general staffs of the army and navy have to agree on the plan of coast defense and to adjust all the projects so as to fit into the general scheme.

The harbor-defense submarines must be under the direct control of the local authorities. We have expressed before our modest opinion as to the necessity of establishing unity of command. In our judgment it should be vested in the commanding general of the department.

In conclusion, the appearance of the submarine has the following effects on coast defense:

1. It makes necessary the creation of system of submarine bases distributed along the coasts, the numbers of which make it necessary that all elements which defend them be mobile.

2. It simplifies the defense of the coasts, keeping at a distance the most powerful and modern battleships.

3. It makes necessary a modification of the defense of dead angles.

4. It makes it necessary that all coast-defense armament be mobile in character, with the exception of a limited number of heavy guns.

5. It requires better co-operation in the plans of the War and Navy Departments for the defense of the coasts, and makes necessary a Chief of Coast Defense with his staff united to the general staffs of the army and navy.

6. It makes necessary an increase in coast defense, but all armament laid down or purchased should be interchangeable with that provided for use in land warfare.

II.—Influence of Airplanes and Dirigibles on Coast Defense

At the outbreak of the European war, and even today among the Allies, the superiority of the airplane over the dirigible was axiomatic. The *Journal of the United States Artillery,* in its competition of 1915, awarded the prize to an essay based on the above proposition. It is generally believed that airplanes and hydroplanes are sufficient to insure an efficient coast defense. Italy and recently England, with the Central powers, are the only nations which have faith in the dirigible.

The reasons given as establishing the superiority of the airplane over the dirigible are, briefly, as follows:

1. The dirigibles require hangars or costly shelters.
2. They present larger targets than airplanes.
3. They have less speed.
4. Both types have about the same radius of action.
5. Four airplanes are equivalent to one dirigible of 20,000 cubic meters capacity in respect to the load which they can carry.
6. The airplane has greater mobility and lends itself more readily to maneuvering.
7. There exists a large number of types and pilots of airplanes, which is not the case with dirigibles.
8. The manufacture of airplanes is easy and simple, which is not the case with dirigibles.

There are three separate and distinct types of military aircraft which we must possess in order to employ them with effect. They are as follows:

1. Scouting aircraft.
2. Fighting aircraft.
3. Gunnery or observing aircraft.

In the following pages we will discuss the qualities which each type must possess and also the missions which they may be called upon to execute in connection with coast defense. The missions are as follows:

1. To observe an extensive zone and to discover in time hostile warships and transports.
2. To fight hostile aircraft and to prevent the enemy from locating our batteries, mines, stations and magazines.
3. To observe and correct the fire of our batteries.
4. To attack hostile submarines and other craft and to protect our mines.
5. To reconnoiter and attack hostile artillery and infantry in the case of an attempt to disembark.

The Air Scout

First, we will treat of the duties of the scout airplane and of the necessity of establishing a system of air defense of the coasts of Spain and adjacent islands. This question has been given much attention in the United States recently, and one of the projects brought forward in the *American Aero Club* is as follows:

The Atlantic, Gulf and Pacific coasts are to be divided into 44 zones or sectors for the air patrols. In order to guard these sectors of the coast, 44 squadrons, with radio installations, stations, hangars, etc., will be required and with other equipment will involve an expenditure of 10 millions.

The central station of each zone will be established if possible at some naval base in the zone.

It would probably be impossible to install this system along all of our coasts in time of peace on account of the large expenditure involved. However, part of this system could be installed permanently and at once, especially along our Galician coast and in the vicinity of the Straits from Cartagena to Guadiana, with a

few stations in Baleares, Canaries, and Africa. This plan being carried out in time of peace, the entire system of air patrols would be extended rapidly to the rest of our coasts upon the declaration of war.

With such a system, the general staffs of the army and navy would find themselves in continuous communication with the stations along our coasts, and in case of war they would be promptly advised as to the point which the enemy intends to attack.

This system should be under the command of the commanding general of Coast Defense in whose zone the airplanes operate. Both staffs would co-operate in reconnaissance of the coasts and in guarding the sea areas with rapid scout cruisers. In this manner the approach of the enemy would be known one or two days before a disembarkation could be attempted. It would give us time to concentrate a part of our mobile land forces, coast-defense troops, submarines, etc., at the threatened point.

In order that this system be carried out with the greatest advantage possible, large units of mobile troops must be permanently stationed at strategic points, prepared always to move to the threatened point. To these mobile troops, a strong detachment of mobile artillery will be added. The enemy will find himself at a disadvantage, for upon presenting his troops he will find that we are prepared to attack him vigorously and that we have at hand a powerful mass of artillery which he did not expect.

It is believed that the scout airplane is the type best suited for the air patrol of our coasts. They are independent of the airplanes permanently assigned to the coast defenses, the duties of which will be discussed later.

Scout airplanes must possess great speed and be capable of observing from 50 to 100 miles from the coasts. They will have to carry a pilot, who should be equipped with a pair of powerful field glasses. They should be able to carry a radio outfit and to maintain communication not only with the shore stations, but also with the scout cruisers on the high seas. They will require little or no armor, for their duties will be similar to those of land patrols in the service of information, *i. e.*, to discover the hostile ships and transports and fly to report, but not to fight.

We are not wholly in accord with all of the ideas advanced as to the superiority of the airplane over the dirigible. As far as fleets are concerned, the German operations in the North Sea are very convincing. The British Grand Fleet knows how many times the dirigibles of the German navy have upset its plans and of the manner in which the Zeppelins have covered the North Sea from their base in Helgoland. The English are convinced of the usefulness of the dirigible, and are constructing them in numbers for use with their fleet. In the future it will be difficult to conceive of a grand fleet without its air cruisers for use in scouting by land and sea. The English are using small dirigibles in coast defense, but these are not very efficient on account of their small radius of action.

Such craft should have the following characteristics:

1. Be able to enter and leave the shelter in a strong wind.
2. Radius of action of twelve to fourteen hours, with 65 to 70 km. per hour speed.
3. Have a powerful radio outfit.
4. Have a good armament, offensive and defensive.
5. Be able to halt and even to anchor or come to rest on the sea.

There are in existence to-day dirigibles which fulfill the above characteristics with a capacity of 10,000 to 18,000 cubic meters.

In our judgment, a dirigible of this type is superior to the airplane. It can move slowly or rapidly, graduating its speed to conditions. It can stop or anchor, and therefore see and scout better. It can give a more prolonged service than in the case of the airplane. Besides being able to use its radio while halted, it can also use any other system of signals that may be used on board ship or on shore.

For the reasons given above, we prefer the formation of a system of dirigible fleets to a system of numerous squadrons of airplanes. This does not indicate, however, that the airplane is not a most important aid of the dirigible.

Fighting Aircraft

The mission of the fighting aircraft is to destroy or at least attack hostile aircraft, preventing them from discovering the location of our batteries, stations, mines, magazines, etc. The present war has shown that hostile aircraft have been used with effect in directing the fire of warships against shore batteries and ships protected by them. This makes it necessary that we have at hand a sufficient number of aircraft in order to prevent the enemy from using his in the manner outlined above. It was without doubt by means of aerial observation that the *Queen Elizabeth* bombarded the Peninsula of Gallipoli and destroyed the Turkish coast batteries along the Dardanelles.

Another duty of fighting aircraft is to prevent hostile aircraft from attacking elements of our coast defenses with aerial bombs.

In order to carry out the mission outlined above, the principal duty of fighting aircraft is to obtain the command of the air in the vicinity of the threatened coasts and to maintain it. To accomplish this, it is important, according to the advocates of the airplane, permanently to assign two fighting airplanes to each patrol zone or sector in time of peace. Even when two or more points along the coasts are threatened at the same time, the fighting planes of the other zones or sectors and those of the reserve would be able to go to the aid of the other.

The European war has shown that the best method of destroying hostile aircraft is to attack them in the air, besides using anti-aircraft guns against them.

The fast biplane scout has proved in its successive types, its speed and power of climbing being easily controlled, that it can count on these two important elements. In a fight between planes the most effective arm is the machine gun. The airplane is very little damaged by rifle and machine-gun bullets. The best results are obtained by high-explosive shell.

COAST DEFENSE—Continued

The Russians have recently used the large Sikorsky type in their air combats. Such machines are capable of carrying 16 persons, with a corresponding cargo of grenades and bombs.

The French call their fighting airplanes "destroyers." They are of the "pusher" type and have the machine gun mounted in the direction of their axis. They are able to fly at more than 2000 meters, carrying bombs and a radio outfit. According to our reports, the caliber of the machine gun is superior to that of the rifle.

It is said that the German airplanes have suffered a complete transformation with the change from the old to the new apparatus. The new type is a large biplane of about three times the size of the older types. They have great climbing power and carry an unprecedented load of machine guns, bombs, radio outfit, etc. This type of machine will play an important rôle in the future, and we will have to follow its evolution and prepare to equip our military establishments with it.

There are three methods of attack for which our fighting planes must be prepared: boarding or fouling, bombarding, and the use of machine guns.

To board or foul a hostile plane is the means best adapted to insure the destruction of both machines. It is dangerous, but useful only in case it is necessary to destroy a hostile dirigible or airplane, and must not be employed except in some unforeseen case or when other action will not be effective.

Another form of attack is to drop bombs on the hostile airplane, but this method of attack is of doubtful success on account of the small target presented. Our fighting airplanes should be able to obtain good results when dropping bombs during an attack on dirigibles, ships of war of all classes, land targets, masses of artillery and infantry, etc. This form of attack is in its infancy and not very effective at the present time, but without doubt will be scientifically developed in the future. For this reason we must provide our fighting airplanes with drop-bombs and instruct our aviators how to use them.

In the present war, the machine gun has been proved to be the best and most efficient arm for air combats. In the future, it is probable that they may be able to carry guns of larger caliber, taking into account the possibility of increasing the power of the motors. These rifles or small guns will be mounted on the front of the machine, so as to give them large arcs of fire.

The fighting airplane, according to its advocates, must possess the following characteristics:

(a) Great speed, combined with ability to climb quickly.

(b) Powerful armament of machine guns or automatic guns and the necessary apparatus for dropping bombs.

Aside from the exclusively destructive power of the airplane and observing that its future armament depends upon its motive power, the dirigibles in a state of perfection much less advanced than that of the airplanes, have made 40 raids over England, two on Paris, six or eight in Russia, and three over Bucharest. Only two were destroyed by airplanes and three by anti-aircraft guns. It may be deduced that the most dangerous enemy of the dirigible will be the dirigible. Dirigibles are already armed with four automatic guns of 3.4 to 5 cm. and two machine guns. An air cruiser with this armament, which will be increased in power with progress, is an element of defense which must be taken into account. If there is added to the above the facility of carrying heavier apparatus, it will allow the air cruiser to carry an accurate bomb-dropping apparatus, and will enable it to take over more fully the mission of destroying hostile dirigibles, besides the principal one in the fight for the command of the air. The dirigible of the future will be the king of the air as to-day the dreadnought is the king of the seas.

Observing Aircraft

For our object and restricting ourselves to coast defense, observing aircraft acquire less importance for the reason that almost all of our military ports possess high sites, and also because for the observation of fire, kite balloons and captive spherical balloons may be used at such places as Cadiz, where the sites are low.

Notwithstanding that the illumination of targets and mine fields is necessary, it is evident that dirigibles anchored or attached to rafts should be able to fulfill this necessity.

The dirigible and the observing airplane have to discover the hostile submarines, and they must be under the control of the local authorities. Such matériel will be of the older types, as their mission will be much easier than in the case of fighting aircraft.

The French have developed a class of apparatus for this work to which they have given the name of "artillery airplane." It is required that they fly up to 1000 meters, and they are armored from below against rifle and shrapnel fire. They carry a radio outfit, and for observing fly very slowly, but are capable of climbing rapidly. Their speed is easily varied to suit conditions. Two airplanes of this type should be permanently assigned to each one of our important naval bases in addition to the fighting airplanes described above.

Skillful pilots and trained observers will be carried in these airplanes, both of whom should be familiar with the terrain in which they operate, and have a knowledge of the technique of fire. This is very important, and the same is true of being able to give exact details of all that they have observed. Communication will be maintained with the artillery commander of the place by radio or by other signals. They must be prepared to inform him promptly not only of the situation, forces, and effectiveness of the hostile ships and troops, but also of the results of the fire of our batteries and, if it should be necessary, to correct such fire.

In order to report photographically the military situation, they must be provided with a powerful camera.

They will have an opportunity to obtain clear and detailed military information which will be of the greatest value for the officer in command.

Effects of the Use of Aircraft

In the foregoing discussion we have given the characteristics of aircraft in the attack and defense of the coasts from the point of view of observing and controlling the fire. There are other applications of aircraft in connection with coast defense, such as the discovery of submarines (which can be seen from the air at depths of 50 to 75 feet); the illumination of zones beyond the range of searchlights; the discovery of mine fields, when the visibility of these has not been masked by covering the mines with mirrors which reflect the sea, or covering them with marine plants, as the Germans have done; the bombardment and destruction of defensive works, etc. All of these missions are of importance and require for coast defense the command of the air in the vicinity of the coasts.

This imposes naturally a great variation in our system of coast defense and in the armament of our fortified places. When the present defenses were planned there did not exist the danger of attacks from the air in the vertical direction, nor of indirect fire from ships, with aerial observation and control, nor the unforeseen fact that a submarine could come to the surface in dead angles. All of these dangers impose new means of defense. We have mentioned those of an offensive character, the necessity of airplanes and dirigibles, the increase of armament or anti-aircraft guns, and the fact that all guns, as well as the illuminating devices, should be mobile. We will leave for another article the description of the new mobile matériel for coast defense, and the tactics of illumination which to-day are imposed. We will restrict ourselves to enumerating the effects of the new means of fighting and the *passive means* of defense which are imposed.

The passive defense of coast fortifications impose:

1. Concealment.
2. Mobility of coast batteries.
3. Protection against vertical fire.

Concealment.—The necessity of cover from the view of an enemy is imposed by modern warfare. This has been made difficult in coast warfare on account of the profiles of our batteries and of the appearance of the airplane which can fly over them and discover all of their details. Therefore, in constructing a coast battery, means for concealment must be adopted, such as planting trees and shrubs, and painting so as to blend into the terrain, etc.

The necessity for concealment imposes the most ample use of the periscope, the armoring of the command stations, the protection of searchlights, the interlocking of batteries and arranging them in multiples, and provision of ample protection for batteries against vertical fire from hostile aircraft.

Mobility.—The attack of the allied fleets on the Turkish coast fortifications has given a new example of the absolute impossibility of reducing shore defenses by means of a fleet acting alone. History has taught us this lesson many times. It is certain, then, in case of war, that our coast defenses will be attacked both by sea and by land. In attacks by land, it is not to be doubted that they will be subjected to fire from guns and howitzers of large caliber, similar to those used with effect by the Germans in the sieges of Liége, Namur, and Antwerp. The enemy will use airplanes, which, co-operating with his batteries, will direct and correct their fire.

After having seen the pictures of the Belgian forts, it requires but little imagination to predict what would remain of our coast batteries if they were subjected to 30.5 to 42 cm. shell fire. Besides, we must expect to be shelled by guns of 35 to 38 cm. of hostile battleships. There are navies which are equipped with shrapnel of 30.5 cm. capable of carrying 12,000 to 15,000 bullets. Can one imagine the effect of one of these on one of our columns?

If we are to be fired on by powerful artillery by sea and by land, it may be deduced that we must have large and powerful guns to resist them. It imposes armament of the largest calibers, and, as a consequence, it must be mobile (or a large part of it), in order to be able to concentrate and to give life and elasticity to the defense.

In the present European war, mobility has been proved to be the best method of avoiding the destructive effect of hostile artillery fire directed by airplanes. Mobility is considered such an important question today that artillery commanders have strict orders to move their units some hundred meters towards the flanks when they have been seen by a hostile airplane. These orders are positive, and they must not return to their original positions until they are morally sure that the enemy has ceased firing and has no intention of repeating the bombardment. In order to confuse the fire of the allied artillery, the Germans have prepared three or four emplacement for each one of their batteries, all widely separated. As soon as an aviator discovers a battery in one of its sites, it is immediately changed, taking a position in one of the others. This method has proved very effective, and we may apply the same principles to coast defense.

The question of protecting our searchlights against all methods of aircraft attack is of great importance, and mobility solves it. Not only are they vulnerable on account of their visibility, but also on account of the lack of mobility. Shrubs and vines may be planted in the vicinity of the stations. However, the best results from both points of view, concealment and protection, will be obtained if they are placed in armored casemates. Mobility can be obtained by mounting them on wheels or railroad trucks.

The appearance of the airplane and dirigible require in general the following modifications in our system of coast defense:

1. Command of the air along our coasts.
2. Provision of a system of air squadrons of dirigibles and airplanes for scouting, fighting, and observation.

COAST DEFENSE—Continued

3. Provision for a subdivision of local aircraft for each artillery command, for scouting and observation.
4. Provision for making the coast artillery mobile.
5. Changes in the methods of protecting our batteries and accessories.
6. Unification of command, co-operation of land and sea forces.
7. Concealment of all works and cover for them from aerial attack. Employment of the periscope.
8. Provision of several sites for each battery.
8. Interchangeability of heavy artillery, except certain large calibers.

COLLEGES

—Military Training in

See

EDUCATION, MILITARY—IN SCHOOLS AND COLLEGES

COLOMBIA

—Army—Organization

[Spanish Officers to Organize Constabulary. *Mem. del Estado Mayor,* Aug, '16.]

Lieut.-Col. José Agudo Pinto and Capt. José Osuna Pineda, both of the Spanish Army, have arrived at Bogota, under engagement with the Government of Colombia to organize a gendarmerie body and to reorganize the National Police of the country.

Colombia is the second Spanish-American nation to procure the services of Spanish officers; the other one being Salvador.

[The Colombian Army. By Lieut.-Col. Francisco López, M. General Staff. *Mem. del Estado Mayor del Ejército* (Colombia), Aug, '16. 1300 words.]

1. *Organic Laws*

By law 152 of 1896, the Government was authorized to issue to the Army, regulations covering the following subjects: garrison service, service in the field, interior administration of troops, sanitary and camp administration, subsistence of troops, military instruction, service in the militia, mobilization, maneuvers, tactics of the three arms, and subdivision of the country into military commands.

The same law prescribed that the details covering military conscription, organization of the army, promotions, pensions, mobilization and pay of the armed forces, should be incorporated in special laws.

Also the Government was authorized to organize courts of honor for the investigation and punishment of violations of social obligations; the punishment in these cases being of a moral character instead of a disciplinary nature.

In carrying out the provisions of the law, the following acts have been acted

Compulsory military service, laws 167 of 1896, and 40 of 1909;

Organization of the Army, laws 22 of 1909, and 89 of 1914;

Pay of the Army and construction of appropriate barracks, law 99 of 1913;

Retirements, pensions and rewards, law 71 of 1915.

The following regulations compiled by two officers of the Chilean Army, named Ahumada and Guillen, have been issued to the Army:

Exercises and maneuvers for Artillery and Infantry, Infantry Firing and Manual for Army Cooks.

Compiled by Diaz and Charpin, distinguished officers of the Chilean Army: uniform regulations, garrison service regulations, field service regulations; compulsory military service regulations, regulations for the Military Academy and for the War College, limits of punishment, signal drill regulations, including flag and semaphore.

Compiled by Negret and Rojas, officers of the Colombian Army: interior administration.

Compiled by the General Staff: topographical conventional signs, march tables, rail and water transportation.

Compiled by the War Department infantry drill regulations, machine gun regulations, cavalry drill regulations, firing manual, first aid and litter drill, physical drill, care and maintenance of the horse.

Promotion and mobilization laws are the only ones which have not been enacted. The law regulating promotion has passed the Senate and it has been read twice in the House of Representatives.

The organic law of the Army, and one requesting authority to send abroad a special military commission, have been submitted to Congress.

Among the decrees issued by the Chief Executive are: decree 1144 of Dec 13, 1911, regulating compulsory military service; and decree 1060 of the current year, which revoked a prior decree authorizing substitution of persons whose names have been drawn for military service.

2. *Lineal and Relative List*

A complete and corrected list of all officers of the army, approved by the President, in conformity with the law, has been published by the personnel division of the War Department. This list includes the names of the following classes of officers: those whose names appear in the War Department report of 1898; those appointed pursuant to the provisions of the Military Code and of decree 1113 of 1908; those whose nominations have been confirmed by the Senate; and those whose appointments have been examined and legalized by the President, pursuant to law.

3. *Military Instruction*

In 1915, at the request of Major Saez of the Chilean Army, the President canceled the contract which the Colombian Government had with this officer. Since then the instruction has been under the supervision of Colombian officers.

Regulations have been issued prescribing the courses of instruction at the War College and at the schools for enlisted men.

4. *Retirements*

Law 71 of 1915 prescribed the details in reference to retirements, pensions and rewards of the personnel of the Army.

—**Army—Uniforms**
See
UNIFORMS—COLOMBIA

—**History**
See also
SOUTH AMERICAN WARS OF INDEPENDENCE

—**Military Geography of**

[Report to Accompany the Reconnaissance of the Region Southeast of Bogota (Colombia). By Capt. Santos Rodriguez, Attached to the General Staff. *Mem. del Estado Mayor* (Colombia), Aug, '16. 4000 words.]

The report covers the San Cristobal sector, and is discussed in the following subheads:

1. General description of the terrain.
2. Statistics as to population and resources.
3. Tactical consideration as regards avenues of approach.
4. Special tactical considerations, reference being made to the natural advantages of the mountain passes for defensive operations.

COLORS

See
FLAGS

COLT-MARLIN MACHINE GUN

[Machine Guns by the Thousands. *Scientific American*, Jan 13, '17. 3000 words. Illustrated.]

The Colt-Marlin machine gun is being manufactured at the rate of 200 guns per day by what is probably the largest machine gun plant in the world. This gigantic industry, which is located at New Haven, Conn., was conceived, planned and realized in less than a year by a group of men headed by Mr. A. F. Rockwell of Bristol, Conn. The bulk of the output is going to the Russians.

(An illustrated description of the gun itself and of the methods of manufacture in this particular plant is given.)

COLUMBUS RAID

[The Columbus Raid. *Jour. U. S. Cavalry Assn.*, Apr, '17. 2500 words.]

Columbus, N. M., a town of about 400 inhabitants, distant about 2½ miles from the border, was raided by (about) 700 or 800 Villistas in the early morning hours of Mar 9, 1916. Columbus was occupied at the time by headquarters, seven troops and the machine gun troop of the 13th U. S. Cavalry, and a small sanitary detachment. The 13th Cavalry had been on border duty at Columbus since September, 1911. There had been numerous alarms. About Mar 5 or 6 there were rumors that Villa was to come across the border and give himself up. Due precautions were taken to receive him, on hostile or friendly mission. Two troops were sent to Gibson's ranch about 14 miles distant, and one to Bailey's ranch (Border Gate) about 2½ miles from Columbus and on the border. On the night of Mar 7, further information caused an additional troop to be sent to the border gate, whence both troops were ordered back early in the morning of Mar 8.

The night of Mar 8 was particularly quiet in camp. Captain Castleman, the officer of the day, after inspecting his guard remained awake reading until 4 a. m. and was preparing to make his final inspection when the Villistas attacked. The night was very dark. Realizing that Villa had attacked Columbus at last, Captain Castleman ran first to the guard, ordered them to open fire, then along the line of stables turning out the stable men, and thence to his troop quarters and assembled his men.

The Villistas attacked the town in two main groups, each of 300 or 400 men, one of which attacked the camp and the other the town. The attack upon the camp was resisted by the troops turned out by Captain Castleman. The attack on the town was resisted by individual soldiers. The sudden onrush isolated most of the officers from their troops.

Fighting continued until about daybreak (5:40 a. m.) when the Villista bugles began sounding the retreat. Two troops pursued the retreating Mexicans for about 15 miles and inflicted severe casualties. Being then practically out of ammunition, these two troops were forced to return to Columbus.

The Villistas lost about 215 killed, and an unknown number of wounded, probably several hundred. The loss of the 13th Cavalry was seven killed and eight wounded. Eight civilians were killed and five wounded.

"COLUMN TIME"

See
MARCHES AND MARCHING—SPEED AND DISTANCE

COMBAT

See
AERONAUTICS—COMBAT
INFANTRY—TACTICS—COMBAT

COMMISSARY

See also
KITCHENS, MILITARY
RATIONS
SUBSISTENCE

COMMISSION

See also
OFFICERS

COMMUNICATIONS

See
SECURITY AND INFORMATION

COMPANY

—**Administration of**

[Instruction and Administration of the Company. By Capt. Picón. *Memorial del Ejército de Chile*, Apr '17. 6500 words.]

(An article on company instruction and administration, in which the duties and responsibilities of a company commander are indicated under the captions, "Generalities," "The Captain in the Instruction of the Company," "The Captain in the Administration of the Company," "The Captain in the Direction of His Officers," and "Final Considerations.")

COMPANY—Continued

—Tactics

[Tactics and the Size of the Company. By H. B. F. *Military Historian & Economist,* Jan, '17. 2500 words.]

The size of the infantry company depends upon whether or not it is to be deployed in one or two lines for decisive attack. The present U. S. Army Infantry Drill Regulations prescribe a deployment in one line, the supports for the firing line being furnished by other companies of the battalion. For decisive attack the firing line should be about 125 yards long and contain about 125 rifles, the maximum that can be efficiently commanded by one officer. This supposes the deployment in one line, which manner of deployment is not correct. Fighting in two lines the frontage should not change, since the captain's ability to direct the fire will not be diminished, but the size of the company must be doubled so that, in decisive attack, its supports may be as large as the firing line. This larger company would be cheaper on account the relatively smaller overhead charges, and at the same time on account of its greater fire effect would be more efficient tactically.

In attack, the company can advance from the point where the enemy's rifle fire becomes effective to the assaulting position only with the assistance of its own fire. This zone of advance, from 1200 yards to 100 yards from the enemy, usually contains the decisive portion of the attack. The attack will succeed when the company's fire is so efficient that it can beat down the enemy's fire and advance without ruinous losses. Observation shows that in this advance the company will have to replace numbers equal to the strength of the firing line. By pushing forward another company to support the one already on the firing line, as now provided for in our Drill Regulations, all organizations of the firing line and the whole system of command, fire direction and control and communication are broken up and must be reorganized just at the time when such reorganization is most difficult. In any serious attack it will be impossible to avoid mixing the companies before the assaulting position is reached, but this mixing can be postponed and even lessened by giving the company sufficient strength to fight in two lines, thus driving its own firing line thru the greater part, or all, of the zone of effective infantry fire.

As above proposed the complete company should consist of one captain, mounted, two first lieutenants, two second lieutenants, one first sergeant, one Q. M. sergeant, one mess sergeant, four sergeants, sixteen corporals, four cooks, five musicians, one artificer, one clerk, two wagoners (one with field kitchen) and 250 privates.

COMPULSORY MILITARY SERVICE

See also

Argentina—Military policy of—Compulsory military service

Australia—Military policy of—Compulsory military service

Canada—Military policy of—Compulsory military service

Chile—Military policy of

India—Military policy of—Compulsory military service

United States—Military policy of—Compulsory military service

[A Word More on Compulsory Service. Capt. Galarce. *Rev. del Círculo Militar,* Dec, '16. 1800 words.]

In framing the laws regulating obligatory military service, the fundamental purpose to be accomplished, namely, the military preparation of the citizens for the national defense, must be kept steadily in mind. The problem is how best to attain this purpose with due regard for social and economic needs.

The experience of the present war clearly demonstrates that we cannot await the moment of struggle before beginning our military preparations. Keeping in mind the thousand and one difficulties attendant upon efforts hastily to improvise or reorganize an army, and the early incidents of the present war, let us contemplate what might have happened if England, for instance, had been able to place two million trained men in the field at the outbreak of the war, with two million more well-instructed soldiers to draw upon.

Happily for us, the old system has been discarded and the matter at issue at the present time is the period of service in the ranks to be required of the annual contingent called to the colors. Those who claim that six months is sufficient to develop a soldier, and who point to the hastily trained armies now fighting in the trenches, fail to consider the special features of this kind of warfare.

In trench fighting, the rôle of the soldier is simple: locked up in a redoubt or under cover of a protecting wall, he need only know how to preserve his health and to aim a rifle. But if we consider the thinly settled and extensive open regions of our probable theaters of operations, the task of our soldier would be very different. Personal initiative and collective efficiency must be developed to the highest degree, and this cannot be accomplished in less than a year of intensive training.

During the past two years the instruction of the class has been very incomplete, and in the case of some individuals, ridiculous.

[Conscription. Editorial. *Army & Navy Jour.,* May 5, '17.]

The Confederate Congress very sensibly established conscription early in the war (1862) when war was popular. Did any Yankee volunteer find he was a better soldier than a Southern conscript?

The first Confederate army of one hundred thousand men were volunteers. Some of Stonewall Jackson's volunteers objected to being transferred to the list of conscripts. He gave them five minutes to decide whether they would be shot down or withdraw their objection.

During the French Revolution the French Congress established a conscription, taking all men between twenty and twenty-five years of age into the army. When Napoleon came into power he had that changed to taking all boys the year they became eighteen years old. At the battle of Jena, October, 1806, the French destroyed the Prussian army and made a treaty of peace in Berlin that prohibited Prussia having ever an army of over 40,000 soldiers.

This, of course, forced Prussia to adopt the French conscription, as she was surrounded by enemies ready to attack her wherever she was weak. Finding that this system gave the most efficient armies with the least expense and made every one living in that country take an interest in their nation, she has continued it ever since. The other German principalities gradually adopted conscription, and as a result of it, Bismarck's war on France in 1870 made a united Germany.

[Obligatory Military Service in the Most Advanced Nations. By Lt.-Col. Diaz. *Memorial del Ejército de Chile,* Sept, '17. 2000 words.]

(This article gives a short account of the scheme for obligatory military service in each of the following European states: Switzerland, Russia, Germany, Austria-Hungary, France and Montenegro.)

A majority of the civilized nations have implanted obligatory service in the form of a permanent army with a corps of professional officers especially trained for their duties, and in which conscripts are required to serve during the time necessary for them to receive complete instruction. The period of instruction has been placed at one year as a minimum, but in the most modern armies this period has been increased to two and even three years, this without diminishing to a marked extent the annual contingent of recruits upon which the formation of reserves is based.

Switzerland and Montenegro offer typical examples of the "defensive" system of national defense. The other countries named offer examples of the "offensive" system based upon a permanent army in which the officers and non-commissioned officers are professionals.

(The contrast is shown between the military strength developed by the French and Russian systems on the one hand, and that developed by the systems of Germany and Austria-Hungary on the other.)

—Conscientious Objectors

[The Litigious Legion. *Army & Navy Gazette,* Feb 24, '17. 350 words.]

The British Home Secretary has announced that 3025 men have been sentenced to imprisonment by court-martial, transferred to civil prisons, and reported to the Central Tribunal as alleging that their offenses were prompted by a conscientious objection to military service. Of these 3025 men, 2297 have been offered release from prison and from future military service on condition that they perform work of national importance; 265 men have refused release on these conditions.

—In the Civil War (U. S.)

[Conscription in the Confederate States of America. By R. P. Brooks. *The Military Historian and Economist,* Oct, '16. 8500 words.]

At the beginning of the Civil War, manufacturing in the South was in a rudimentary stage; this fact, added to the Federal blockade, made it hard for the Confederate Government to equip its troops. It was comparatively easy to raise as many volunteer troops as could be equipped. The early engagements of the war, successful for the Confederates, made enlistment popular. As the first year of the war drew to a close, it was seen that it would be difficult to persuade the volunteers to re-enlist and consequently President Davis on Mar 28, 1862, recommended to Congress the inauguration of a system of conscription, and on Apr 16, 1862, Congress directed the conscription of all white males between the ages of 18 and 35 not legally exempt, and also that all men of conscript age already in the army be retained therein for a period of 3 years from their original enlistment. The good results of this legislation were at once apparent in the increased strength and efficiency of the army. On Sept 27, 1862, the conscript age was extended to 45 and on Feb 17, 1864, Congress extended the age limits to include all between 17 and 50 years, at the same time providing for the use of free negroes and slaves in certain auxiliary services. The final step in the extension of compulsory service took place Mar 13, 1865, when Congress authorized the sending of slaves to the front. None were sent, however, for the end of the Confederacy was at hand.

As explained above the first act enrolled all those not legally exempt, and Apr 21, 1862, Congress passed the Exemption Act excusing the following classes from military service:

1. The physically and mentally unfit.
2. Confederate, and the higher State officials.
3. Mail carriers, telegraph operators and employes of common carriers.
4. Ministers of the Gospel, members of college faculties, and teachers having as many as 20 pupils.
5. Workers in employments essential to the production of munitions.

So great was the dissatisfaction produced by the publication of this law that Congress was soon called upon to pass a new act describing in great detail those who should be exempt from military service. Another means of escaping service was provided by authorizing conscripts to offer substitutes, such substitutes to be of required age, mentally and physically sound, and from one of the classes not subject to conscription. This kind of soldier proved more troublesome than any other; the substitute deserted in such numbers that the War Department was finally forced to hold the original conscript liable for service if his substitute deserted.

At first the administration of the conscript system was under control of the War Department but in December, 1862, the Bureau of Conscription was established. General J. S. Preston, the head of this bureau, was of the opinion that this work should not be placed entirely in the hands of the military, for their idea

COMPULSORY MILITARY SERVICE-Continued

was to obtain soldiers, and when called upon to decide whether or not a certain man should serve, the general public interest was very liable to suffer.

Of course those who were unwilling to volunteer would do anything to avoid conscription. Physicians discovered so many unsuspected defects in the families of their clients that non-resident examining boards were required; there was a great rush for minor positions in the state governments and in industrial employments which afforded exemption, and fifty thousand men secured temporary immunity by purchasing substitutes. But the total number of all these was small in comparison with the number of men who ran away upon the approach of the enrollment officers. Evasion and desertion became more prevalent in 1863 and grew worse in 1864 and 1865. General Lee urged the rigid enforcement of the death penalty in the cases of those convicted of this offense. None of the many expedients adopted by the Government to prevent evasion and desertion were successful. The only possible remedy would have been a military force sufficiently strong to enforce the orders of the Bureau of Conscription, but the depleted numbers of the Confederate Army made the detail of such troops out of the question.

Tested by the number of troops it raised it is very doubtful whether conscription in the South was worth the exertion, internal discussion and public opposition it aroused. There is great discussion as to the number of troops actually raised, but accepting the most favorable possible showing for conscription, it appears that that system put into the army not more than twenty-five per cent. of the total. It is almost unfair to credit conscription with having done even so much, for the conscripted class was almost entirely worthless as fighting material, and most of the admitted one hundred thousand desertions belonged to that class. The lax exemption laws brought the central government into conflict with some of the states and resulted in making service in the army unpopular. These very laws, providing an easy and more or less honorable method of avoiding service, kept out of the army thousands of men who otherwise would have been forced by public opinion to volunteer.

It is difficult to avoid the conclusion that compulsory military service as administered in the South during the Civil War was a failure, but one important fact must be remembered. But for the Conscription Act the Confederacy might have collapsed in the spring of 1862, for the most important provisions of that act were those which forcibly retained in the army those men who had already enlisted.

CONCON, Battle of

[Battle of Concón. By Major Arturo P. Luisoni. *Rev. del Círculo Militar*, Dec, '16. 1500 words (continuation). To be concluded.]

(Gives order for the disposition of the troops after landing, including measures of security and information, and the special tasks of the engineers and cavalry.)

Owing to the fog and high seas, which caused the vessels to drift during the night, the disembarkation, which should have commenced at daybreak, was delayed for hours and the plan for the first day was completely disarranged.

The Pisagua battalion was put ashore at 9 a. m. to cover the landing, and was followed in order by the second, first and third brigades.

The second brigade began disembarking at 10 a. m., and marching on Las Palmas via Dumuño and Quintero, arrived at dark on the banks of the Aconcagua.

The first brigade was ashore by 2 p. m. and assembled at Concón Bajo by 8 p. m.

The third brigade did not complete the landing until 11 p. m., and, owing to the fog and lack of guides, missed the way and did not reach Colma until six o'clock the following morning.

At daybreak of the 21st, the enemy was found in force on the south side of the river, with light troops guarding the crossings. Under fire of our artillery and the rifle company armed with the new Mannlicher, the fords near the mouth of the river were reconnoitered; but all attempts to force a crossing by the Verdejo ford were unsuccessful, owing to the deadly effect of the hostile fire.

Efforts to establish superiority of fire were unavailing, due to the raw and undisciplined condition of the men and animals of the mountain batteries, which rendered this powerful arm of little use.

[Battle of Concón. By Major Arturo P. Luisoni. *Rev. del Círculo Militar*, Jan, '17. 2500 words. (Conclusion.)]

The presence of strong forces of the enemy in front of the 2d and 3d brigades limited the tactical offensive in this direction to a frontal attack, but our first brigade, lying concealed on the right, had apparently not been discovered by the enemy, and only small detachments of hostile observation troops were visible on the opposite bank. A suitable ford having been found in front of the first brigade, the attack was planned as follows:

The 2d brigade to attack in front; the first brigade to cross near the mouth of the river and attack and envelop the left flank; the cavalry covering the right of the first brigade to gain the road to Viña del Mar, thru which led the enemy's line of communication to Valparaiso and Santiago.

The attack was carried out as planned, the crossing of the first brigade being covered by a vigorous rifle and artillery fire from the north bank and by shrapnel fire from the ships near the coast which swept the high ground on the south bank and prevented the enemy from occupying advanced positions to impede the crossing.

The defeat of the enemy was complete, and his troops fled in disorder by the mountain paths to escape the cavalry which was taking prisoners on the road to Viña del Mar.

Of 11,000 of the Dictator's troops participating in the battle, 1800 were killed or wounded, including their

leaders—Generals Barbosa and Alcerreca—3000 were scattered in the mountains, 2000 taken prisoners joined the Constitutional army, and only 4200, completely demoralized, found their way to Viña del Mar.

The utter demoralization which overtook the government forces was due in great measure to an unfortunate misunderstanding arising during a critical stage of the battle between Generals Barbosa and Alcerreca, which led to both generals refusing to give or take orders or make proper dispositions of their commands. Confusion and disorder soon spread to the ranks, and one battalion even opened fire on another, claiming that it was trying to desert to the enemy.

The Constitutional forces, tho poorly trained and equipped, as compared with the Dictator's army, had a decided advantage in the Mannlicher rifle with which they were armed over the Comblain and the Gras, and in the employment of open-order formations introduced by Lt.-Col. D. Emilio Korner, while the loyal troops were still using antiquated formations in mass.

CONSCRIPTION

See

COMPULSORY MILITARY SERVICE

CONSUMPTION

See

TUBERCULOSIS

COOKING EQUIPAGE

See also

KITCHENS, MILITARY

COOKING, Military

[Note. *Army & Navy Jour.*, Mar 10, '17. 200 words.]

The British army has advertised for a thousand women cooks and waitresses for service with various units. It is contended that trained women cooks will render better service, in the United States army, as well as the English, than men, who require a great deal of training to become competent cooks.

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[. . . Cooks for Army Cantonments. *Official Bulletin*, July 23, '17. 1500 words.]

The Q. M. General has requested of 58 hotel associations the "loan" of 3840 cooks for use in the 16 cantonments for the National Army. This will furnish 15 cooks for each regiment. A school for cooks will be organized at each cantonment. The hotel cooks will take care of the cooking at the beginning of the mobilization and of the training of the cooks to be appointed from the organizations. It is expected that the professional cooks will be required for a period of a month to six weeks.

Three men will be chosen from each company to be trained as cooks and the hotel cooks will have supervision over them until the work is well organized.

COOTE, Sir Eyre

[The Early Life of Sir Eyre Coote, 1726-1758. By L. Fitzgerald. *United Service Magazine*, Oct, '16. 4000 words.]

(Biography; his career and influence in India.)

COURTS-MARTIAL

—Chile

[Military Jurisdiction. By P. Charpin, Major, General Staff. *Mem. del Ejército* (Chile), Oct, '16. 1250 words.]

(A study intended to clear up by means of examples certain doubtful points regarding the jurisdiction of Chilean military courts, including the classification of offenses and the sentences to be awarded.

The nature of the offense, and not the jurisdiction nor the attending circumstances, determines whether or not the sentence imposed is the one fixed by the Penal Code or the one prescribed by military orders.)

CUPOLAS, Gun

See also

FORTIFICATIONS—PERMANENT—ARMORED TURRETS

CURTISS AEROPLANES

—R-4 Tractor

[Curtiss Model R-4 Tractor. *Aerial Age Weekly*, Dec 25, '16. 900 words. Illustrated.]

The Curtiss Model R-4 Tractor has a span, upper plane 48'6", lower plane 38'2", length over all 28'9", height over all 13'. Motor used is a Curtiss 200 h.p., speed ranges from high speed 90 miles per hour, low speed 50 miles per hour; net weight is 1800 pounds, the wing curve used is R. A. F. 6 with a slight stagger between the wings and dihedral angle of 3 degrees. The fuselage is 24'6" long; Dep control is installed. A slotted disc of leather is provided where wires run thru the cloth. The dashboard instruments consist of an air speed indicator, aneroid reading to 10,000 feet, electric clock, revolution indicator, oil gauge, magneto switch, inclinometer, Sperry compass. Electric lights are disposed about the cockpit and dashboard. Landing chassis of two wheels with 26x5" tires; the axle is 1¾" in diameter. The motor is Curtiss V-2 type 3 rated at 200 h.p., normal speed 1400 r. p. m., maximum speed 1500 r. p. m., minimum 200 r. p. m. It is of V-type, with eight cylinders arranged at 90 degrees, bore 5", stroke 7", equipped with two high tension 8 cylinder Berling magnetos situated on front of crank case cover. Two Zenith carburetors between cylinders inside the V. Motor weighs 667 pounds; provision is made for installation of self starter. The starter weighs 30 pounds.

DANISH WEST INDIES

—Sale of to United States

[Note. *Army & Navy Jour.*, Jan 20, '17. 300 words.]

The three Danish islands—St. Thomas, St. John, and St. Croix—have been purchased by the United States for $25,000,000. It is probable that a joint board of army and navy officers will be sent to the islands to provide for the military protection of the group, and for the immediate establishment of a naval station.

DARDANELLES, Operations at the (1915)

[Conclusions from the Dardanelles Campaign and Lemnos, the Helgoland of the Aegean Sea. By Bavarius. *Jahrbücher, deutsche A. u. M.*, June, '15. 1000 words.]

DARDANELLES—Continued

The Dardanelles campaign was a political move to prevent a Turkish-Arabian attack on the Suez Canal and Egypt.

Neither France nor England will permit unrestricted Russian possession of the Dardanelles. England has seized Tenedos, Imbros and Lemnos to prevent egress from the Straits.

The expedition failed because of lack of sufficient landing troops, lack of preparation, undervaluation of the Turks, and overestimation of the knowledge of the Dardanelles possessed by Admiral Limpus, who trained the Turkish navy.

Even the armament of the *Queen Elizabeth* proved insufficient against the forts, as the direct fire guns had no effect within the works or upon the hidden batteries. The lighter armament of the defenders was effective against the armor of the vessels. The transportable coast batteries were invulnerable, and will revolutionize coast fortification. The high-angle fire guns of the Turks caused heavy losses to the Allies. The unsuccessful attack demonstrated that Germany is superior to England in relation to artillery, as in naval and aeronautical matters and in intelligence and morale of officers and troops.

Lemnos. As England will never voluntarily return Dunkirk and Calais to France, so she will never voluntarily return Lemnos to Greece. The pretext for seizure was that as Greek sovereignty in the island had never been recognized, it was Turkish soil. The English did not interfere with the Greek officials until certain that Greece would not join the Entente.

England recognizes this "Turkish Helgoland" as the most important point in the Mediterranean. It is 454 square kilometers in area, and has 30,000 inhabitants. It is indented by a gulf on the north, and another on the south which is the rendezvous of the Allied fleet. It has ample anchorage and wharfage facilities. The inner bay is sheltered, and hardly within range of hostile guns. The island is easy to defend.

Lemnos forms the key to the Dardanelles. Together with Cyprus, guarding the Suez Canal, and Malta, dividing the Mediterranean, its possession may assure to England for years to come the mastery of the seas.

[Six Weeks of Fighting at the Dardanelles. By Lt.-Col. Wochinger. *Jahrbücher, deutsche A. u. M.*, June, '15. 2200 words.]

Five objects led to the Anglo-French expedition against the Dardanelles: (1) to furnish munitions to Russia; (2) to transport to the west the grain accumulated at Odessa; (3) to persuade the Balkan States and Italy to join the Entente; (4) to compensate Russia by offering her Constantinople; (5) to remove danger from Egypt.

Russia has been appeased and has promised to land an army in Thrace, but demands unconditional possession of the Dardanelles, while England desires naval bases there. Greece refused to aid, hoping for a restored Greek Empire with Constantinople as its capital. Rumania and Bulgaria refused, fearing to be surrounded by Russia. Italy refused, having no excuse to abandon neutrality. The failure of the expedition can be partly ascribed to the failure of these states to participate, as success of an attack from the sea depended on the clearing of both sides of the straits of Turkish troops. The pompous announcements of the Allies gave Enver Pasha time to assemble hordes of enthusiastic volunteers.

On February 16th, forty-two Allied war vessels, mostly of old types, assembled at Lemnos. These were followed by four divisions of troops and later 60,000 more men followed. General d'Amade was in command. The operations are divisible into three periods.

1. Serious naval attacks were made on Forts Sed-dil Bahr and Kum Kalesi, February 19th and 25th. The forts were put out of action.

2. After the repulse of landing parties, a passage thru the mine fields was cleared, and the fleet advanced, March 18th, coming in range of the modern inner forts and the hidden batteries equipped with high-angle fire guns. The fleet suffered great losses. On March 20th the English Admiral had only eighteen ships capable of maneuvering. The Turkish losses were small, the expenditure of ammunition unimportant, and the forts left intact. The lessons of this action are: (1) the great value of high-angle fire guns against ships; (2) the uselessness of direct fire of ships against hidden batteries; (3) the great value of transportable coast guns.

3. The Allied fleet was now reinforced by all the available ships in the Mediterranean. The Admirals waited for the arrival of reinforcements, giving bad weather as an excuse. March 26th the mine sweepers renewed their activities. The Turks had replanted the mine fields, which had to be again removed. The fleet actively but unsuccessfully bombarded Tschanak Kale and Kilidbahr. A landing force of 32,000 men now arrived. General d'Amade declared, however, that the plan of further operating thru landing troops could not be carried out, because of insufficient troops and lack of shelter, provisions, and medical personnel. The English, in view of the political situation, insisted on carrying the action to a conclusion. As a result, d'Amade sailed to Egypt, leaving the expedition without landing troops.

The month of April, therefore, saw the Allied leaders in open disagreement, with no gain and many losses, while the enthusiasm of the Turks was raised to the highest pitch. The Balkan States were confirmed in their neutrality, and the prestige of the Central Powers was increased in the Orient and North Africa. Revolts of Mohammedan tribes broke out on the Russian border and in Soudan and Morocco. The future alone knows what fruit the unsuccessful expedition will bear.

[The Attack of the Dardanelles, 1915. By E. L. *Svensk Kustartilleritidskrift*, Part 4, '15. 2600 words.]

(A review of a book, by Lt. D. Laudquist, entitled "The Operations at the Dardanelles.")

[Mesopotamia and Dardanelles. (Conclusion.) By Lt.-Col. H. Lecomte. *Rev. Mil. Suisse*, Dec, '16. 4000 words. Maps.]

If the government of India is responsible for the Mesopotamian check, the English government itself bears the responsibility for the Dardanelles fiasco.

On the continent the Englishman is generally considered as a cold, methodical calculator, who leaves nothing to chance. The manner in which the Dardanelles affair was conducted does not confirm that impression. As for Bagdad, they appear to have been dazzled by the end in view and not to have sufficiently prepared the means.

It would seem that, when Turkey entered the war at the end of October, 1914, the defenses of the Dardanelles could not have been in a very effective condition. We may believe that if, shortly after the declaration of war, a solid English fleet, reinforced by a strong landing force, had presented itself at the Dardanelles, it would have had some chance of forcing the straits. Instead of that, there was only an insignificant bombardment on Nov 3, then calm for more than three months.

The reason for this delay appears to me very simple. At that moment, France and England needed all available men in Flanders to stop the German drive on Calais. Against the straits, there was nothing but the fleets and no troops to support them. The English statesmen lacked experience in military matters, but they certainly knew of the not very glorious expedition of Admiral Duckworth in 1807. The English actually forced the straits and stayed in the Sea of Marmora for 11 days. They decided, however, not to bombard Constantinople, because there were no troops to land. The question as to whether the fleet could have forced the straits is then an idle one, for such an exploit would have been fruitless without a landing force.

It was probably not by chance that the allied fleet waited till Feb 19, 1915, to renew the attack. By appearing before the Dardanelles on the anniversary of the day on which Duckworth had forced them, they probably wanted to raise the morale of the crews and damage that of the enemy.

But was that a sufficient motive for waiting three months and a half? And why was the fleet, in spite of the lessons of 1807, not accompanied by an army that could be disembarked?

It is probable that the necessity for a landing force was well recognized. For reasons connected with morale, the 19th February was fixed as the date of the attack. On that day the fleet was ready, but not the army. In spite of that, they decided to commence the attack with the fleet alone, expecting the army to follow when it could.

The combined fleet consisted of 16 battleships and battle-cruisers, four of which were French, under the command of the English Vice-Admiral Carden. Among others was the superdreadnought *Queen Elizabeth,* brand new, carrying eight 380 mm. guns, from which wonders were expected.

In spite of foggy weather, which made fire control difficult, the forts at the entrance to the Straits were quickly put out of action. Beginning on the 25th of February, the fleet attacked the interior forts. The *Queen Elizabeth* fired from a distance of 18-20 km. on the fort of Kilid Bahr; she was in the Bay of Saros and fired over the Gallipoli peninsula. In the meanwhile, mine-sweepers were at work preparing for the passage of the battleships.

Small detachments of marines were landed to complete the destruction of the forts of Seddul Bahr and Kum Kaleh on Mar 4. They found the nearest villages occupied by the enemy and seem to have reembarked as soon as they had finished their task. What would have happened on that day if a division of infantry had landed?

Bad weather interrupted operations for a month. On Mar 18, Admiral de Robeck had succeeded Admiral Carden, perhaps on account of the English admiralty's impatience to force the passage, to reach Constantinople by means of the fleet alone and there dictate terms.

The attacks ordered on that date failed completely. Three large vessels were sunk by floating mines. Two others were disabled. The fleet was obliged to wait for the army. This wait lasted more than five weeks. The Turks had had, since the declaration of war, more than six months to prepare their defense.

Why had not the Allies acted sooner on land? A French report of Apr 8 stated that the French expeditionary corps had been concentrated in Egypt, ready to support the fleet since Mar 15. A résumé prepared by the American general staff tells us that the commander-in-chief, General Ian Hamilton, was present at the action of Mar 18 and that, at that time, the English and French troops were on their transports in the port of Mudros, on the island of Lemnos. But it appears that the English transports had not been loaded in view of a landing under fire, and the port of Mudros was not suitable for reloading. Everything had, therefore, to be sent back to Alexandria. A month was thus lost.

Is that the true and only reason? Was there not, perhaps, a moment of discouragement after the check of Mar 18? Perhaps they were afraid to strip Egypt of troops. Perhaps something more was lacking than means of reloading transports. However that may be, the landing in force, which should logically have been effected at the end of February, did not take place before Apr 25.

The English expeditionary corps comprised 100,000 men. The French contributed 35,000 men.

The landing was not made without difficulty and gave the English a foretaste of what was in store for them. In spite of the Turkish resistance, however, an English division got a foothold at several points on the south point of the peninsula, the Australian and New Zealand corps more to the north. For several days these two corps vainly tried to join. The French made a feint on the Asiatic shore, then landed behind the English.

The months of May, June and July were passed in bloody attacks and counter-attacks, with no appreciable results. The English had lost 50,000 men without having been able to occupy Krithia, the heights of

DARDANELLES—Continued

Atchi Baba or those of Sari Bair. The Anzac corps, separated from the main army, was still in danger of being thrown into the sea.

On Aug 7, a new English corps landed more to the north, in Suvla Bay. This corps and the Anzac corps attacked the Sari Bair heights. If this maneuver succeeded, the assailants could have taken Maidos back of the Kilid Bahr and Atchi Baba forts. The Anzac troops got a footing on the Sari Bair heights but, ill-supported by the Suvla corps, they were driven out.

The troops landed at Suvla were not sufficiently seasoned and were commanded by inexperienced leaders. In his report General Hamilton complained bitterly of the corps commander, General Stopford, and of the division commanders. He accused them of allowing an almost certain victory to escape them thru lack of initiative.

After the failure, the Allies attempted nothing serious any more. The entrance of Bulgaria into the war and the invasion of Serbia by the Austro-Germans put an end to the situation. On Dec 20, the Allies reembarked their Suvla and Anzac troops and transported them to Salonika. They abandoned Seddul Bahr in the early part of January. The result was nil; the enterprise had been a complete fiasco.

Enver Pacha, like Napoleon before him, was naturally overjoyed. He claimed to have immobilized 500,000 English and French. This may be an exaggeration, but there were probably more than half that number. The losses admitted by the English exceed 120,000, without counting the navy.

Evidently he who risks nothing gets nothing, and it appears that the Allies were more than once very near success. German officers have said that, at a certain time, the Turks lacked ammunition. Enver Pacha confirmed it. An energetic push at the right moment might have forced the passage. Perhaps the moral effect of such a victory would have provoked a revolution in Turkey. That is not impossible, but the example of 1807 made that eventuality too uncertain to base on it a plan of campaign.

Perhaps the Entente is able to-day to maintain and supply a million men in the Balkans; at the beginning of 1915, it certainly was not, and that alone should have caused the abandonment of the enterprise.

Who knows if the hundreds of thousands of men immobilized or put out of action at the Dardanelles would not have tipped the scale in the great September offensive in Artois and Champagne?

[The Dardanelles—First Phase. By A. MacCallum Scott, M.P. *Contemporary Review*, Apr, '17. 4000 words.]

The Interim Report of the Dardanelles Commission is concerned only with the controversial issues growing out of the origin and inception of the attack upon the Dardanelles—with the purpose of the attack and the responsibility for the plans. The report is not a record of facts, for these have been suppressed in large part, and even some of the conclusions have been excised. Its value as a guide to public opinion is therefore considerably diminished, but the reason for suppression is clear. It would be criminal to publish information of value to the enemy or that would lead to controversies between the Allies. It is better to err on the side of safety. Under the circumstances, it is difficult to resist the conclusion that it would have been better either to have postponed publication, or to have published only the conclusions. The report concerns only the naval attack on the Dardanelles. It makes critical inquiry concerning a specific enterprise which failed, but ignores necessarily the almost miraculous achievements of the government in other respects. The Commission fails to distinguish between the local object and the supreme object which embraced all the fronts and concerned even distant India.

Mr. Walter Roch's minority report indicates that in the early plans of the War Council there were three schools of thought—a western school, an eastern school, and a sort of intermediate school. The Dardanelles attack was the outcome of the eastern school.

The question of this attack was first raised by Mr. Churchill at a meeting of the War Council, Mar 25, 1914, but the proposal was abandoned due to shortage of tonnage. On Jan 2, 1914 (1915?) a telegram was received from the British Ambassador to Russia urging a demonstration against Turkey to relieve the pressure in the Caucasus and Lord Kitchener telegraphed promising that a demonstration would be made. There was a deadlock in the west. The Balkans were seething and Egypt was seriously menaced. The situation on the Indian frontier constituted one of the most serious factors, as the Germans were active in that quarter. It was imperative that their lines in that direction be cut, and the Dardanelles offered the most tempting prospect of success with the smallest expenditure of effort. The defense of India, the Balkan situation, and the Russian call for help could all be dealt with in one operation. A year of effort failed, but it had its effect on the general situation. The blood shed in Gallipoli served the end of victory as did that shed on the retreat from Mons, in Flanders, or on the Somme.

Mr. Churchill favored a joint naval and military attack on the Dardanelles. It was rejected because Lord Kitchener declared that no troops could be spared for the purpose.

On Jan 28 it was definitely decided to attack with the fleet alone. Lord Kitchener remarked that one of the merits of such an attack was that it could be broken off at any time if not progressing satisfactorily. Lord Fisher opposed the plan because he planned other use for the fleet, and reluctantly acquiesced in the Dardanelles plan so long as its proportions were such as not to interfere with his other plans. When it became involved with a great expeditionary force later, he tendered his resignation.

The Commissioners, except Mr. Roch, condemn Lord Kitchener for hesitation in sending the Twenty-ninth Division to Gallipoli which resulted in a delay of three weeks at a critical time, but this delay was the

result of deliberate judgment as to the requirements of the western front. Whose judgment could be accepted if not Lord Kitchener's?

The Commission states that after the failure of the naval attack, we "drifted into the big military attack," and charges hesitation and vacillation. Mr. Churchill advocated a joint naval and military attack and maintained that troops were available. The tremendous military importance of the enterprise and its relation to the campaign as a whole gradually became more apparent. It was a blow at a vital part of the German strategic plan. Untoward developments on the western front caused a fatal delay and the golden moment was lost. The attack was pressed with increasing forces. Great gain resulted elsewhere, but the immediate prize was beyond our grasp.

By adopting the policy of a great military attack, Lord Kitchener admitted that his earlier judgment was wrong. His other achievements are sufficient to cover this error.

The function of the Commission is not to judge the ministers, soldiers, and sailors, but to ascertain the facts and report them to Parliament for its judgment.

[Attacks On the Dardanelles, 1807, 1915. By Katherine F. Doughty. *United Service Magazine*, May, '17. 2400 words.]

(Historical resumé.)

[The Admiralty Board and the Dardanelles Report. By Percival A. Hislam. *United Service Magazine*, May, '17. 3200 words.]

(A résumé. The conclusion drawn is that the whole trouble of the Dardanelles would in all probability never have arisen if the Admiralty had been represented in the Cabinet by a seaman instead of a civilian; for in that case there could never have been a moment's doubt as to the expert's duty when any matter specially pertaining to his department was under discussion.)

[A German Staff Officer on the Dardanelles Expedition. Translated by Thomas F. A. Smith. *Jour. Royal United Service Institution*, May, '17. 3500 words.]

On Mar 25, 1915, the chief command of the Turkish forces for the defense of the Dardanelles was offered to and accepted by the German Field-Marshal Liman von Sanders. The naval attack of Mar 18 had probably convinced the enemy (British and French) that the Dardanelles could not be forced by naval power alone. But huge land forces were known to be concentrating on the islands of Lemnos, Tenedos and Imbros, with reinforcements arriving daily.

The new chief inspected the peninsula, corrected the disposition of the Turkish forces, and began the construction of a network of roads, using Armenian and Greek Christian working battalions. A thin line of guards was left along the coast, companies and battalions were placed at possible landing places.

Various rumors reached von Sanders, but he merely continued his preparations. The British commander gave him exactly a month in which to complete his preparations, which proved just sufficient. The companies at the important points were well entrenched, with reserves in rear sufficient to hold out until the big divisions could come up.

The heavy British bombardment opened at dawn on Apr 25. A feint was made at landing at Besika Bay, on the Asiatic side. A landing was made at Kum Kali and what remained of a Turkish company was captured. A night attack supported by heavy artillery effected the re-capture of Kum Kali, but the troops withdrew to the south to escape the naval bombardment next day, and again occupied the village in the evening, after 36 hours of continuous fighting. A considerable quantity of matériel was captured. The losses were heavy on both sides. The French continued their efforts to gain a foothold on the Asiatic side until Apr 29. All attempts failed, and no further landing was made.

On Apr 25 the landings at Kaba Tepi and Ari Burun were attempted. The first was beaten off, and at Ari Burun the attackers were driven back to the heights contiguous to the beach.

Reports were received of a force in the Gulf of Saros, and of landings at various points. No landing was made at the Gulf of Saros, and the commander-in-chief took the grave responsibility of ordering the two divisions of Turkish troops from that locality to be withdrawn to the support of the heavily pressed defenders of the southern point of the peninsula. The movement had to be made at night so that the British would not discover the absence of troops from that point. The advance troops of these divisions reached Sed-ul-Bahr and Ari Burun at dawn Apr 26.

Another bombardment commenced at 5 a. m. this date, and landings were made at four points—Eski Hissarlik, Sed-ul-Bahr, Teke Burun, and at the mouth of the Singindere. A fifth landing force at Kum Tepe was driven back to the ships.

The final result of the first day's fighting was to drive the landing forces back to the shelter of the cliffs along the shore, except one detachment which reached the heights of Eski Hissarlik and entrenched there. The commander-in-chief ordered a night attack along the whole front. The detachment was driven from Eski Hissarlik heights down to the bay, but the other lines were not broken. Another night attack was ordered for the night Apr 26-27, penetrating the Allied lines near Cape Hellas, but the Turkish troops had to be withdrawn towards morning to escape the fearful fire of the naval guns.

The network of roads for communication was not complete, and the Turkish troops were under heavy strain. On Apr 29 the Allied troops made a general attack on the southern front, participated in by three British brigades on the left and two French brigades on the right wing. The attack was preceded by the customary naval bombardment. The French were driven back by a counter attack, after which the British could not maintain their ground and were forced to withdraw. At first the Turks had only field artillery, the heavy artillery being held for the defense of the narrows. Now the heavy artillery was brought

DARDANELLES—Continued

up. This was probably observed by the British airmen, but they probably also doubted if any ammunition was available. But the German naval captain, Herr von Pieper, had organized munitions works, not only at Constantinople, but thruout the country.

From then on the attacking forces suffered heavily from the Turkish artillery. The attackers dug themselves in at Sed-ul-Bahr and Ari Burun. Their communications were open by sea, whereas the Turkish communications were unfinished and the landing places covered by naval gunfire directed by aircraft. British submarines penetrated the Sea of Marmora. But the energy and activity of the commander-in-chief overcame all difficulties. The Turks entrenched too. Terrific attacks were launched against them by the ever-growing forces of the enemy, but without success. The enemy proved himself brave, but the first act in the struggle of a brave landing force backed by the greatest fleet in the world was ended.

DEAD

—Identification of

See

GRAVES (MILITARY)—REGISTRATION OF

DEBARKATION

See

LANDING OPERATIONS

DECORATION AND REWARD, Military

See also

PENSIONS, MILITARY

United States

[Medals. By Lieut.-Col. Fred R. Brown, Infantry, National Army. *Infantry Jour.*, Oct, '17. 6800 words.]

A description of the Medal of Honor, the Indian Wars, Civil War, Certificate of Merit, War with Spain, Congressional, Philippine Insurrection, and China Relief Expedition medals and the Army of Cuba Pacification and Army of Cuban Occupation badges. Also regulations governing their award and order in which worn with other badges awarded by the Government.

DEMOLITIONS

See also

RAILROADS—DEMOLITION OF
SAPPING AND MINING

DENMARK

See also

DANISH WEST INDIES

DESTROYERS

See also

SUBMARINES—DEFENSE AGAINST

DETONATORS

[Explosives — Detonators. *Information,* Jan, '17. Quoted.]

Recent developments in the substitution of new and more powerful detonators for mercury fulminate were explained to the Philadelphia section of the American Chemical Society at its January meeting.

For many years mercury fulminate has held its place as a detonating substance superior to all others. Of recent years, however, its place has been threatened by other compounds, which bid fair to displace it. One of the most promising of these is lead azide, a salt of hydronitric acid. This acid forms a great number of salts, as mercury azide, silver azide and sodium azide. The heavy azides, as lead azide, are prepared by treating a solution of sodium azide with a soluble metallic salt, such as lead acetate, the sodium azide being prepared from nitrous oxide and sodium amide.

Large crystals of lead azide and mercuric azide have been found to be very sensitive to mechanical shock, the sensitiveness increasing with the size of the crystals. Even the breaking of a single large crystal is said to bring about an explosion. Crystals as large as three millimeters in length, when dry, often explode when brushed with a feather. If a hot saturated solution be allowed to cool slowly, large crystals sometimes form, which detonate under water. This property is scarcely obtainable with the fulminates.

Lead azide in fine crystals appears to be less sensitive to blows than mercury fulminate. It is very stable when stored at high temperatures, such as 50 degrees centigrade; it is decomposed, however, by strong sunlight. The action of lead azide upon metals is slight, while fulminate is quite active. Mercury fulminate may be dead pressed in the primer cup, while lead azide increases its brisance and explosive power with pressure. If detonator caps be loaded with lead azide and a booster charge, much less lead azide is necessary to produce the desired detonation. The sensitiveness of fulminate to mechanical shock is much lessened by the presence of as much as 1 per cent. moisture, while lead azide is much less affected by this amount. This particular property is extremely valuable in case of storage of detonating caps in a humid atmosphere.

Many other substances have been proposed as detonating agents. Trinitroresorcin or lead styphanate has been found to be an excellent explosive. Hexamethylenetriperoxidediamine is said to exceed mercury fulminate four or five times in priming power. A number of others may be mentioned, as nitrogen tetrasulphide, diazobenzoinitrate, basic mercury nitromethane and perchlorate of trimercury aldehyde.

[Initiation of Explosions. By W. Arthur. (*Proceedings of the Engineers' Club of Philadelphia,* vol. xxxiv-3, No. 148, p. 135, March, 1917. Quoted from the *Journal of the Franklin Institute,* Apr, '17.]

Until quite recent times, black powders or kindred mixtures were the only explosives in use. The energy they contained was liberated by the burning of the mixture, only the minutest flame being required to start the ignition, as the various components were extremely finely divided, and only a small amount of heat was sufficient to raise them to the ignition point. The beginning of what may be termed internal ignition in contradistinction to the previous method, which may be styled external ignition, followed the

discovery of mercury fulminate by Howard in 1799. Its ability to fire gunpowder gave rise about the year 1815 to the development of the percussion cap.

The percussion cap may be briefly described as a small metal capsule containing mercury fulminate or mercury fulminate mixture, or other mixture with similar properties. The cap was used by placing it over the end of a small tube leading to the powder chamber. When struck a sharp blow, the mixture detonated, giving rise to considerable heat and igniting the powder. The significance of this invention was as great as the discovery of gun-cotton or smokeless powder, the use of fixed ammunition in modern firearms having been made possible by a dependable primer. The length and heat of the primer flame will determine very largely the character of explosion of the charge. If the flame be short and the temperature not very high, only a portion of the powder may be burned before the projectile leaves the muzzle of the gun. On the other hand, if the primer flame be long and the temperature high, all of the powder may be fired. Mercury fulminate has for many years held its place as a detonating substance superior to all others. In recent years, however, its place has been threatened by other compounds which bid fair to displace it. One of the most promising of these is lead azide, a salt of hydronitric acid.

The chief characteristic of mercury fulminate which makes it valuable as a detonating agent is the ease with which it can be exploded by simple and ordinary means, and the characteristic mode of pressure development which brings about the explosive decomposition of the charge. A large number of chemicals are violent explosives and many exceed mercury fulminate in explosive power, but are less suitable as detonators, or are not suitable at all. Some are too sensitive to shock or friction, others too insensitive; mercury fulminate occupies a middle position. Many investigators have attempted to account for the initiating effect of detonating compounds, but so far no fully satisfactory theory of their action has been formulated.

DIARIES

[War Diaries. By Capt. Urrutia. *Memorial del Ejército de Chile,* Apr '17. 2500 words.]

A discussion of methods of keeping war diaries, their purpose, what they should contain and their final disposition.

German, French and Japanese methods described. With the Japanese the war diary is kept by each unit down to and including the company. They are started on the day that orders to mobilize are received.

In troops of new formation the officers or sub-officers first to arrive start the diary, turning it over to the proper officer upon his arrival. Occurrences are noted in the diary immediately, as the value of the account is diminished when a lengthy period is allowed to elapse between the time of the occurrence to be noted and notation of same.

Except in companies, squadrons and batteries that are a part of regiments, a copy of the diary is sent thru military channels to the Minister of War. The original remains with the unit concerned. The Minister of War extracts data of interest to him and then transmits the diary to the chief of the General Staff.

The diary is closed by each unit on the day of its demobilization.

DIESEL ENGINE

[The Diesel Engine. By Capt. C. L. Fenton and Lieuts. L. B. Chambers and R. R. Lyon, C.A.C. (Extracts from a thesis prepared at the Coast Artillery School). *Jour. U. S. Artill.,* Nov-Dec, '16. 10,000 words. Illus.]

The Diesel engine is one of the many types of internal combustion engines. It is distinctive in its method of operation, and, as to fundamental principles, stands in a class by itself. It operates on what is known as the Diesel cycle, receiving heat at constant pressure, and, after expansion, rejecting heat at constant volume.

The Diesel engine operates on both the 4-stroke cycle and 2-stroke cycle. The 4-stroke cycle consists of first sucking air into the cylinder at atmospheric pressure. The second stroke compresses the air to about 450 or 500 lbs. per sq. in. and the temperature is raised from 1000° to 1200° F. During the third stroke oil is injected into the cylinder under pressure of from 750 to 850 lbs. per sq. in. The fuel is cut off at no later than 1/10 stroke, combustion is completed and expansion continues thruout the stroke. The fourth stroke exhausts the burned gases. The 2-cycle is different in design and construction but not in theory. All the operations of the 4-cycle engine are performed in two strokes of the piston instead of four.

So far the Diesel engine has found favor in but two fields, marine engines and stationary engines. It is being tried in locomotive and portable units but is still in the development stage.

Diesel engines for stationary purposes may be further classified as horizontal and vertical types, single acting and double acting, and 4-stroke or 2-stroke cycle. The single acting, 4-stroke cycle, vertical type has taken the lead over all others in development and use. Engines of this type are constructed giving from 25 to 1000 b. h. p. per cylinder.

The vertical Diesel engine usually is of the "A" type with the base enclosed or partially enclosed. Bed plates are very heavy. Trunk pistons with additional guides or shoes to relieve the piston from excessive wear are usual. The weight of the engine averages from 300 to 350 lbs. per b. h. p.

Because of the high operating temperatures, a satisfactory cylinder design has not been attained. Cast iron still is the best metal, but the most important quality necessary for any material for cylinders is its resistance to wear, which is deterioration of the structure of the metal due to rapid fluctuations of temperature.

Due to its operating on high compression, the Diesel engine must have a close fitting piston and a larger number of rings than usually are employed in other

DIESEL ENGINE—Continued

types of engines, and due to the high temperatures in the cylinders it becomes necessary to cool the pistons in engines of large size.

At present in most of the Diesel engines in operation, compressed air is used for atomizing and forcing the fuel into the cylinder, and also for starting the engine, so that the air compressor is a very important part. But some engines are being operated by solid fuel injection which involves complications in the oil pump. The fuel injecting valve is operated from the main cam shaft. The time the valve is open is constant for all loads. The valve requires regular attention and cleaning. The governing is done by regulating the amount of oil fed to the cylinders.

The cooling system is important because of the high temperatures in the cylinders. The cooling water is circulated by a pump direct driven from the engine. When the engine stops the pump stops, which may cause lubrication troubles. This may be remedied by having an independent water supply, by means of which the cooling water may be kept in circulation after the engine is stopped.

Due to high pressures and heavy construction, some system of positive lubrication is required. Cylinder lubrication generally is obtained by forcing oil thru small radial holes near the bottom of the liner. These holes require constant attention to prevent their becoming clogged with carbon particles.

The advantages of the 4-cycle over the 2-cycle are: lower fuel consumption per b. h. p.; lower average temperatures in the cylinders and less quantity of heat to be transmitted thru the cylinder walls; no scavenging air pump required to expel products of combustion; and better lubrication.

The advantages of the 2-cycle types are: higher power per same cylinder and weight; less troublesome valves; less space required for same power; low pressure and scavenging pump may be used for starting; and it costs less for the same power.

The 2-cycle engine is finding its principal use in the development of high power, where the question of dealing with the exhaust in the 4-cycle type involves multiplicity of valves or auxiliary exhaust ports, and the weight and size are prohibitive.

The Diesel engine is now used in most places where the steam engine or turbine could be used. But its use has not become general in America for the reasons:

1. The availability of cheap fuel has prevented a demand for an expensive first cost prime mover that gives decreased operating costs.
2. American manufacturers have been slow to take up the manufacture and development of this engine.
3. Engines giving satisfactory service have been in operation in Europe only within the past five years.
4. The engine requires careful supervision when being operated.
5. Some prejudice exists against all internal combustion engines.
6. Oil must be used as fuel and the cost varies widely.
7. The manufacture requires exceptional skill in foundry and machine work.

As compared with steam engines and turbines, the Diesel has the following advantages:

1. Can be started quickly and does not use fuel except when furnishing power.
2. Always ready for use and can be started on short notice.
3. High thermal efficiency.
4. Greater economy (neglecting the life of the engine and upkeep after long years of service.)
5. Less cost for labor in operating.
6. Simpler installation.
7. Smaller building and less room required.

It has the following disadvantages:

1. Higher first cost.
2. More intricate mechanism and more easily put out of order.
3. Requires better trained operators.
4. Life unknown.
5. The engine is still undeveloped in this country.
6. More difficult to lubricate.
7. More difficult to manufacture.

Due to the fact that there are in different localities of this country cheap fuels in the form of gas or cheap coal, gas engines have been more developed than have oil engines. These engines have been adapted to meet local conditions, and, except the gasoline engine which has no place in commercial practice for a prime mover, the Diesel engine possesses few advantages over other types of internal combustion engines.

As compared with the gasoline engine now in use in our fortifications, the Diesel has the following advantages:

1. High thermal efficiency.
2. Wide variety of cheap fuel.
3. Easily and quickly started.
4. No electric ignition to get out of order.
5. Reliable on long runs.
6. Crude oil safer to store and losses less than with gasoline.
7. No stand-by losses as compared with a producer plant.

The disadvantages are:

1. Higher first cost per b. h. p.
2. American design still in experimental stage.
3. Requires a higher grade operator.
4. Repairs must be made by the maker.
5. Compressed air must be on hand at all times.
6. Danger of accidents, due to high cylinder pressures and consequent leakage of fuel.
7. Requires a heavy foundation, more floor space, and more head room.

In conclusion it may be stated the present development of the Diesel engine in the United States does not warrant its adoption for fortification work without further test and experiment. But further test should be made and under varying local conditions.

DIRIGIBLES

See also
AERONAUTICS
ANTI-AIRCRAFT ARTILLERY

[Inflation and Manipulation of Dirigible Balloons. By C. F. Smyth. *Aviation*, Mar 15, '17. 940 words.]

The handling of lighter-than-air craft is found by experience in Europe to require much study and experience. To inflate a balloon laid on the ground, with its top exposed, the gas is conducted to a point within ten feet of the balloon thru the main pipe line, and from there into the balloon thru the inflating pipe. As the balloon is inflated the sand-bags are lowered on the network. The ballonets are placed in position before the gas is turned on. After inflation and the proper amount of ballast taken on, the balloon is taken into the field. The captain takes his position, liberat s the water ballast and gives a whistle signal to start the propellers at low speed. It is essential that the dirigible be headed into the wind. The angle of ascent is usually about 10 degrees, but by regulating the propellers so that the speed of the dirigible is the same as that of the wind, the angle of ascent can be made perpendicular from the ground. The landing place having been designated, the ground men are stationed around. The drag-rope is dropped when 100 feet from the ground. This is caught by the ground men, and when the balloon comes near enough to the ground the ground men catch hold of the framework of the balloon. The motors are then stopped, the anchor-rope secured to the mooring device on a car and the balloon trolleyed into the shed. If a car is not provided, the ground men guide it into the shed. In case of engine trouble, an emergency landing is necessary, when a suitable spot is reached. Sufficient ballast is thrown out and the anchor dropped. The anchor catches in a tree or fence and the balloon comes down to the ground.

Germany

[The Development of the Zeppelin Airship. By Count Von Zeppelin. *Aviation*, Oct 15, '16. 2000 words.]

Count Von Zeppelin's attention was first drawn to the possibilities of the airship in 1874. He concluded that the practical airship would have to be of large dimensions on account of the small buoyancy of the air compared to water. This necessitated very light construction and yet extraordinary strength. The first machine was constructed to carry water ballast, fuel for several hours, crew and necessary instruments and make a speed of 9 meters a second. This required a gas bag of 11,300 cubic meters capacity. The frame work was made of aluminum and covered with gummed cotton. The Daimler motor was used with a small 4-bladed propeller. A diameter of 11.6 meters was decided on and a length of 128 meters; and as the entire load could not be carried under the center without necessitating an exceedingly heavy system of girders, two points of support were decided on for the machinery and crew. The cross section was a polygon of 24 sides. The whole space was divided into 17 compartments. The frame, in the form of T bars and angles, was built of aluminum having a specific weight of 2.7 and a tensile strength of rupture of 33 kilograms per sq.cm. The steering in a horizontal plane was done by a box frame work and in a vertical plane by means of a weight suspended below running along a cable. Two motors each drove two right and left hand propellers with raw hide belts. As no lighter gas could be found it was necessary to increase the size of the ship to carry more weight. This allowed higher powered motors to be installed and greater speed secured. A comparison between the first Zeppelin and the Sachsen, built in 1915, shows that the diameter had been increased from 11.6 to 14.8 meters, the length from 128 to 149 meters, the capacity from 11,300 to 20,800 cu. meters, and an increase in lifting power from 9000 to 11,000 kilograms. The construction of the ships has been changed so that while there was a sag of about 25 cm. in the first one there is no appreciable change in shape of the much longer latest one. The first one had a speed of 32 kilometers per hour and could carry fuel for only a 10-hour trip. The Sachsen has a speed of 72 kilometers per hour, can carry 3000 kilograms, and make a round trip of 2200 kilometers.

[Progress in Aeronautics. By Maj. H. Bannerman-Phillips. *United Service Magazine*, Nov, '16. 1600 words.]

The framework of the Zeppelin *L-33*, brought down on the 23d of September, was a credit to the designer and constructor, and appeared to have fulfilled its purpose as an aerial transport admirably. As a naval scout it might be estimated that it had reached the top notch of progress in the art of airship construction; as a weapon of destruction it seems utterly wasted, for even the height of 15,000 to 17,000 feet which it was said to be capable of reaching after dropping its load of bombs, had not availed to save it from the combined attacks of the British anti-aircraft guns and protective aircraft. As a means of forwarding the war, it would have been far better employed purely and simply as an auxiliary to the navy.

With regard to the possibilities of aerial travel in the peaceful future, the continuous efforts of the German airship builders have proved beyond a doubt that the crossing to America by airship will very shortly be within our reach, provided there are hangars of suitable dimensions on both sides of the Atlantic. The modern rigid airship has been shown to be of such power and endurance that, given favorable weather, the *L-33* should have been capable of a non-stop flight of 1500 miles, doing 60 miles an hour, or much more with a favoring wind. It is very doubtful if any pre-war Zeppelin could have done 1000 miles at 45 miles an hour, so that in two years under the spur of military exigencies coupled with an intense desire to impress the enemy with the terrific possibilities of a new and unique engine of war, the German constructors and navigators have gained 30 per cent. on previous records for speed and distance. The value of the naval airship in co-operation with a fleet has been shown by the use made of the Zeppelin by the Germans, and the actual distances covered during non-stop flights during

DIRIGIBLES—Continued

raids over England have been considerable. We may presume, therefore, that in peace-time there will be every inducement to proceed with the improvement of such vessels for use as aerial scouts in the ordinary course of naval development, and incidentally every improvement for purposes of war will conduce to utility for traveling on peaceful errands. The plucky attempt of the Wellman airship to cross the Atlantic was foredoomed to failure, principally by the want of power to overcome the force of the wind, and secondly by the ingenious but hopelessly impractical attempt to neutralize the alternate expansion and contraction and consequent variation in lifting power of the gas by the use of an extraordinarily heavy form of trail rope, composed of fuel-containers linked together by chains, and which alternately rested a portion of its weight on the surface of the sea or was raised into the air. The distance from Liverpool to New York is 3066 miles. The *L-33*, as already stated, may be said to have been capable of doing 1500 miles at 60 miles per hour with its normal war load; lighten the load by omitting all war material such as bombs and searchlights, and reduce the crew to the absolute minimum for working the vessel in three watches for the special purpose of the short period of the voyage, and then load up with extra fuel oil to the extent of the weight thus removed, and allowing for a choice of favorable wind and weather, the speed of the vessel might possibly be increased by 25 to 50 per cent., the voyage reduced to a reasonable time limit, and we might be within measurable distance of accomplishing a non-stop trans-Atlantic flight.

It may seem that with such useful auxiliaries as the Zeppelin airships undoubtedly are to the German navy, the cruisers belonging to the latter should be saved an immense amount of work of a very risky nature, and that the further extension of utility of the naval airship due to increased radius of action and speed may well enable the latter to take the place of the cruiser. As a matter of fact, it is impossible that any aerial airship should ever do this, simply on account of its lack of offensive power and its extraordinary vulnerability. If airships could have performed the duty of surface vessels in the war, the Germans would not have lost thirteen cruisers in the course of hostilities up to date. Airships could not hope to damage the enemy's ships, much less involve them in a serious engagement or hold them until the arrival of their battleships; their mission should be to search for the enemy's forces and report from a distance, and there their utility ends. As regards patrolling the coast line and hunting for submarines and mines, the little non-rigid British airships seem to be quite satisfactory, and much handier and cheaper to build, maintain, and house when at rest.

As a pure matter of nerve strain, there can be little doubt that the men who go up in airplanes at night during a Zeppelin raid over England have more to stand up against than any other flying-men in the service. There is possibly little chance of being hit by bullets or shrapnel compared with a flight over the enemy's lines in France by daylight, but the absence of actual exciting incidents is more than equalled by the certain and well-understood danger to which the "night hawk" is exposed from the peculiar conditions of his task. Altho our aerodromes are better lighted than they used to be, the bringing safely to rest of a fast-flying scout is still no easy matter, and should fog come on while the airman is still flying he runs a strong chance of a very bad landing. In addition, when several aeroplanes are out in search of Zeppelins in the same area, there is a certain amount of risk of collision, especially if there be any mist.

[The Super-Zeppelins. A Study of Their Values and Limitations. By Charles Nordmann. *Revue des Deux Mondes*, Feb 1, '17. 5500 words.]

The moment seems fitting to study the military rôle of the Zeppelins.

They have certainly not done all the Germans expected of them, but they are none the less remarkable in more ways than one.

Why was the idea evolved of putting balloons in a rigid frame instead of continuing to use the supple form which maintained its shape by means of the gas pressure on the envelope?

If the shape of the supple form of airship became altered, because of the resistance of the air, which at high speed digs pockets into the forward part of the envelope, or because of the loss of the contained gas, or merely because of variations in the altitude of the balloon, it followed at once that its motion was hindered and the distribution of its load disturbed. It became necessary to arrange a system of small interior balloons, compressed air being forced in by means of a ventilator operated by the motor, and the small balloons inflated in such a way as to compensate for the variations in gas volume and in the internal pressure.

A balloon whose variable profile should be contained in an envelope of invariable form would not have the inconveniences offered by the former type. Moreover, the problem of suspending the weight by the cars or baskets, and of distributing the weight over the entire envelope would be solved.

Disadvantages of the Zeppelin are that it suffers from high winds when anchored, even if deflated, and that the rigid frame adds a dead weight that decreases, markedly, the climbing power. A supple balloon of 10,000 cubic meters is equal, from the point of view of its load-carrying possibility, to a rigid Zeppelin of from 12,000 to 15,000 cubic meters.

This disadvantage is greatly reduced, however, as the cubical capacity is increased. The supple balloon must have increasingly heavier material for its envelope as its cubical contents increase. Whereas in the rigid type, one merely adds additional small balloons of the same material. A point is therefore reached where the dead weight of the rigid type does not exceed that of the other.

There were other reasons, however, for the construction of the super-Zeppelin.

The ascensional power furnished by a cubic meter of hydrogen is a little more than a kilo, *i. e.*, the cubic meter of gas can lift that weight. The lifting power is proportional to the volume.

For war purposes, the value of an airship depends upon its speed. A greater distance can be traversed, with increased speed, before gas leakage or dispersion forces a return to the supply base; in other words, a greater radius of action is gained.

Moreover, an airship of great speed is not so dependent on meteorological conditions. A war engine should not be the slave of weather conditions.

Increased speed increases security in permitting easier escape from pursuers.

The best way to increase the speed of the Zeppelin is to increase its volume. The greater lifting power permits heavier motors. Air resistance does not increase in the same ratio, because it varies with the square of the balloon's dimensions, whereas the ascensional force varies with the cube. So when the length and width are doubled the resistance of the air is quadrupled, while the ascensional force is increased eight times.

A large balloon loses gas more slowly than a smaller one, because the loss is a function of the surface and not of the volume.

Besides increased speed, the super-Zeppelin gains in weight-carrying capacity, and can therefore transport more projectiles and more combustible material—a gain in destructive power and in radius of action.

These are the principal reasons why the Germans constructed such enormous dirigibles.

The Germans designated their naval Zeppelins by the letter L (*Luftschiff*), followed by a number of order of construction, and those pertaining to their land forces by the letters LZ, plus a number. They have constructed about one hundred, which does not mean, however, that they now have that number.

The skeleton of the Zeppelin is constructed of aluminum. It has the form of a long cylinder. Before the war, it terminated at both ends in symmetrical ogives. Recent models show the front end rounded, the rear end rather sharply pointed. This form is the best, offering the least resistance to motion. The same form is found in the bodies of recent airplanes and racing automobiles.

The recent super-Zeppelins consist mainly of two types: the type of the *L-30*, of 30,000 cubic meters, with a length of 148 meters and a width of 18½; the type of the *L-33* to *40*, which is about 193 meters long, 22.7 meters in diameters at the largest point, and is 54,000 cubic meters in volume.

The dimensions of these recent airships are comparable to those of the *Lusitania*.

The skeleton is formed, as a rule, of a series of transverse meridians, having the form of 16-sided polygons, the sides formed of triangular pieces joined at the polygon angles to square or triangular beams that run from one end to the other of the vessel. All this is of very open construction, like lacework, the longitudinals of light aluminum. Within the framework, a cable runs the entire length, passing thru the middle of the small interior balloons. This brings about certain disadvantages—leaks, sometimes tears—but no way has been devised of dispensing with the cable, which prevents longitudinal yielding.

Additional rigidity is gained from the footbridge or gangplank running along the bottom of the airship. In the super-Zeppelin, this is about 180 meters long and only 30 centimeters wide. It connects the different cars. It is, moreover, triangular in section, and contains, in separate interior compartments, reservoirs for gasoline, oil, water ballast.

The entire skeleton is covered by a light gray, fireproofed tissue, weighing only about 110 grams per square meter. This tissue is not quite waterproof, and the air pressure produces small pockets in it in which rainwater remains sometimes in sufficient quantities to make it lose as much as 6000 kilos of its ascensional force.

Inside this skeleton, and conforming to its shape, are the ballonets, inflated with hydrogen. There are from 17 to 19 of these in the *L-30* type, and from 24 to 26 in the *L-33*. Each one weighs from 200 to 250 kilos. Adjacent ballonets are separated by a thin layer of air, and are provided with safety valves and apertures for inflation, which is done simultaneously for all.

It takes about 48 hours to inflate the ballonets of the *L-33*, at the rate of about 1100 cubic meters per hour.

Because of the diffusion of the hydrogen thru the tissues, a small quantity of this gas is always intermingled with the air surrounding the ballonets, and with that about the footbridge and the balloon itself. The mixture is explosive, and a spark could set it off. It is therefore a great danger, and has already caused the loss of several Zeppelins. The crew is therefore forbidden to smoke or to carry matches. A special apparatus is used to fan the hydrogen away. The firing of machine guns from the front and rear platforms was given up on account of the danger of explosions.

With the 54,000 cubic meters of hydrogen enclosed in the *L-33's*, these ships can, with the loads carried, keep the air for 20 hours and rise to a height of 4000 meters. In these 20 hours they lose from 18 to 26 per cent. of their hydrogen, that is, from 10,000 to 14,000 cubic meters. The baskets or cars are of corrugated aluminum, fastened by bolts to the skeleton, with which they are almost in contact. They are provided below with landing rails or bumpers. They are entirely closed and covered with cloth. There are two of them in the *L-30* type, and four in the *L-33*. In the latter type, the forward car, eight meters long, is for the commander. In the center, to port and to starboard, there are two, five or six meters long, each carrying a motor and a propeller (at the rear); the car at the rear has three motors and two lateral propellers. The forward car is divided into two compartments, separated so that the vibration of the motor will not interfere with the wireless apparatus. The rear compartment carries a motor and a propeller. The commander is in the front compartment. Half a dozen operators and mechanicians are there under the eyes of the commander; also the control mechanism of the rudders that cause the ship to rise or to descend; the levers to the water boxes, situated in the gangway, which allow the water to run out when it

DIRIGIBLES—Continued

is desired to rise quickly; those controlling the valves in the ballonets; the maneuvering telegraph, similar to that on the bridge of a ship; telephones, speaking tubes, compasses, maps, etc.; the controlling gear of the bombs. This last permits the bombs suspended by light hook along and underneath the footbridge to be dropped at will. A disk, numbered to correspond to each bomb, is illuminated by electricity when a bomb is released.

Recent super-Zeppelins carry a supplementary car, or basket, called the reconnaissance basket, which can be lowered by a winch and cable arrangement to a position 800 or 1000 meters below the balloon. From this position an observer can telephone to the commander. The observer's position is far from enviable.

The dirigible of 30,000 and 54,000 cubic meters carry, respectively, four and six motors of 240 horse-power; they have six vertical cylinders, turning at the rate of 1400 revolutions per minute. They are of the Maybach water-cooled type, and consume 200 grams of gasoline and oil per horse-power. These motors operate four and six propellers, respectively, of a diameter of 5½ meters.

The armament consists of four and six machine guns, respectively. In the *L-33* type, there are two guns in the forward car, two at the front of the platform running under the superstructure of the Zeppelin, and two at the rear of this platform. These last are not used now, for reasons already stated. The cartridges used in these guns are of a special manufacture and produce but little flame when fired.

The armament is completed by the load of bombs, which have a total weight of 2350 kilos in the *L-33;* there are also a score of fire bombs, which are thrown by hand.

The ascensional force of the late super-Zeppelins is about 60 tons, *i. e.*, their 54,000 cubic meters of hydrogen can support in the air the enormous weight of 60,000 kilos.

The water ballast consists of about 12 tons; the fuel and oil for the motors of about 6 tons; the crew and their supplies of about 2½ tons; the guns, munitions, and bombs of about 3½ tons. The deadweight of the balloons is 36 tons.

Thus loaded, the airship can travel 80 kilometers an hour, being able to brave almost any ordinary wind, and can keep this up for 24 consecutive hours.

To rise, a part of the water ballast is released, thru pipes. To rise 100 meters, from 1 to 2 per cent. of the weight transported must be released; to rise to 3000 meters, about 30 per cent. must be released, *i. e.*, about 8 tons of ballast.

The faculty of rising almost instantaneously, thanks to the ballast, is one of the advantages of the dirigible over the airplane.

But the Zeppelin can rise without releasing the ballast, by means of inclining the planes carried for the purpose. It can also descend by similar means.

The Zeppelin also has fins, so to speak, which serve the purpose of steadying the vessel and preventing or reducing pitching. These planes are at the rear and act like the feathers of an arrow.

It is concerning the crews of the super-Zeppelins that we have the least information. We know, however, that they include about 20 carefully selected men, whose training takes several months.

The crew is far from being sufficient to handle the airship upon its starting or landing. Landing is a difficult operation, often resulting in accidents, and the lightest breeze may then break the fragile framework. Several hundred men must certainly be needed when the weather is bad, and this fact constitutes one of the gravest defects of the Zeppelin.

In 1916, Germany constructed about thirty Zeppelins. She lost, thru accidents, explosion, or destruction, about the same number.

From a purely military point of view, dirigibles have a double strategical and tactical rôle. On the one hand, their great load-carrying power permits them to undertake important bombardments. On the other hand, they can perform reconnaissance and bring in or transmit information.

As to the bombardments, the Zeppelins have in no way come up to the expectations of the Germans. One of the reasons for this failure is found in their great size. They offer a gigantic target to the anti-aircraft batteries now established everywhere along the army fronts.

To engage in bombardment, an airship must fly over the targets and locate them with accuracy; furthermore, it must descend quite low if it hopes to hit anything. The fire of the anti-aircraft batteries is now effective both day and night (thanks to the searchlights); and if the airship escapes these, it has still to reckon with the pursuing airplanes.

Zeppelins have been forced to abandon all attempts at bombardment in the theaters of operations, and to confine themselves to secret raids against distant objectives of no particular military importance. From this fact has arisen the criminal practice of bombarding unprotected towns. It is thanks to the Zeppelin raids and atrocities that the British lion really woke up.

Striking the balance sheet for all the 41 raids (some by 12 Zeppelins at a time) made against England, we find the result represented by about 1500 victims, of which 500 were killed—hardly equal to what one machine gun does in an hour.

On the other hand, these huge whales of the aerial ocean have been used effectively in the service of security and information. There seems to be little doubt that they were contributory to saving the German fleet in the battle of Jutland, by announcing long in advance the arrival of the main force of the English Home fleet, which they were able to perceive (from their great elevation) at a distance of more than 100 kilometers.

Yet it is quite certain that in this role of observation, much smaller dirigibles, or airplanes only, could do just as much.

On the whole, these monstrous Germanic constructions have completely failed from a military point of view.

[Capture of the Zeppelin *L-49* in France. *Air Service Journal*, Nov, '17. 3000 words. Photographs.]

The *L-49* is 600 feet long and has a diameter of 90 feet. The hull frame is made of aluminum alloy and is formed of longitudinal and transverse girders, covered with stout netting over which the outer cover of linen is fitted. The hull is painted black except on top where it is silvered.

The *L-49* has five motors of 250 h.p. each, and four cars. It can develop a speed of fifty to fifty-five miles an hour.

The workmanship and construction of the craft are poor, altho its equipment is excellent. The wireless installation resembles closely that of a transatlantic liner of the latest type. Forward of the wireless room is a control station furnished with a fiber mat and a three-ply glass windshield to assist in keeping the occupants warm. Aft of the wireless is the engine-room, where the largest of the engines actuated a direct-drive propeller. The after engine compartments each contain two engines driving in tandem a single propeller.

Inside of the hull are nineteen gas bags of gold beater's skin, with ballonets built into them. These are meant to absorb the overflow of gas or to be inflated by air valves. Also in the hull are water tanks of canvas having a capacity of 200 quarts. There are sixteen gasolene tanks from which the gasolene is piped to the engines. The arrangement is such that one tank can feed any one engine or all of them.

Italy

[What of the Dirigible Balloon? *Scientific American*, Nov 17, '17. 1400 words. Illustrated.]

The latest type of dirigible invented by the Italian, Mr. Forlanini, is said to possess so many distinctly new features that it has placed the Forlanini design in a class of its own, and has materially broadened the field of the dirigible balloon.

This design can rise to great heights in perfect safety. During trials it ascended to an altitude of 17,500 feet, which is a world's record for dirigible airships. It made a journey of 8 hours' duration at an elevation of 13,000 feet. The Zeppelin type can attain only 12,000 feet after every possible object that can be dispensed with is thrown overboard. Furthermore the Forlanini airship has an excellent chance of escaping hostile airplanes because it can climb 3300 feet every four minutes. The best of airplane climbers can rise 1000 feet per minute up to 10,000 feet when the rate drops rapidly.

For bombing operations the Forlanini design is said to approach the ideal. It can remain 40 hours in the air, covering a distance of 2000 miles. With a useful load of 6000 pounds it can rise to 13,000 feet; with less load it can rise to 20,000 feet. Because of its ability to rise quickly to great heights it should prove immune from anti-aircraft defenses.

The Forlanini airship has a double envelope: an inner or gas envelope and an outer one completely surrounding the former. A continuous and entirely free air space is left between the two envelopes. The gas envelope is fitted with transverse and longitudinal diaphragms. A rigid truss girder runs from the bow to the stern, thus stiffening the entire structure. The girder is axially suspended from the gas envelope. The car or nacelle is arranged close to the envelope and is rigidly suspended from the truss. For steering purposes flexible surfaces of grate-like construction are used. The propelling apparatus is split up into independent sets. The screw propellers are arranged for adjustable and reversible pitch, which enables the airship to reverse on its course. An upper platform is provided on top of the gas bag, and is connected to the car by means of a ladder passing thru the well. These improvements serve to lower the resistance to flight, to maintain stability during the descent from high altitudes, and to maintain the regular external form of the dirigible.

United States

[New Navy Dirigible *DN-1*. By Charles F. Smyth. *Aviation*, Dec 1, '16. 660 words. Illustrated.]

The New Navy Dirigible *DN-1* was shipped to Pensacola, Fla., to the Naval Aeronautical Station, for the final flying tests. The preliminary power plant and blower tests had been previously passed at the factory. This dirigible is of the non-rigid type; its over-all dimensions are: length 175 feet, height 50 feet, beam 35 feet. The balloon carries a volume of 115,000 cubic feet of hydrogen gas, which gives a lift of approximately 7000 pounds. There are two ballonets for navigating purposes, one in the rear, with a volume of 8000 feet and one forward with a volume of 7000 feet. These ballonets serve both to navigate the airship and to assist in maintaining its shape, which is apt to be affected at different altitudes by temperature changes. The gondola is fastened to the bag by means of a suspension composed of numerous ropes and cables fastened to the belly-bands of the bag. In the car itself there is an eight-cylinder Sturtevant 140 horsepower engine. The power is delivered by means of an upright shaft into the two cross shafts arranged overhead that drive two four-bladed propellers, and the blower, which is used to keep the ballonets inflated.

As a safety device an auxiliary motor is installed to drive the blower in case of the main power plant stalling. This auxiliary is a 1½ horsepower air cooled, single-cylinder Indian motor. The two propellers are very large and powerful, operating at half motor speed at about 800 revolutions per minute with pitch and diameter of eight feet. Efficiency is claimed to be about 73 per cent. The gas bag is built of two-ply rubberized cotton fabric, the strength of which is 70 pounds per inch for both warp and weft. The permeability is 35 cubic feet in 24 hours at two feet water pressure. This dirigible is designed for speed between 25 and 30 miles per hour, with endurance at full speed of two hours; it has a passenger carrying capacity of about seven men, rate of ascent and descent is 6 feet per second. The equipment consists of a full set of instru-

DIRIGIBLES—Continued

ments, including a barometer, barograph pressure gauges, chronometer, air speed meter, inclinometer, statoscope, and compass, all made very light. There is also a complete first aid kit as well as provision for supplies and food for long trips.

[The First Dirigible for the U. S. Navy. Anonymous. *Schweiz. Zeit. f. Art. u. Genie,* Jan, '16. 1500 words.]

This airship was manufactured by the Connecticut Aircraft Co., which seven years before had made the first airship for the army. Certain improvements have been made over this army airship. The gondola is of the Körting type and can float. Other improvements are: division of the balloon into four compartments which communicate below; two spherical ballonets, to give greater stability; maneuver and safety valves on the base of the balloon; a secure attachment of the balloon to the frame, which can be easily released by modern levers.

Instead of two 60-h.p. motors, a 120-h.p. motor is used to drive the two propellers. The steering mechanism is all concentrated in one wheel. There are both advantages and disadvantages in this arrangement. The method of anchoring is also novel, and in trial the airship easily rode out a 50-mile wind. The principal dimensions are: length, 52½ m.; greatest diameter, 10½ m.; displacement, 3115 cu. m.

—Bomb Dropping Mechanism

[The Structure of the Newer Zeppelins. How the Bombs Are Dropped. *Sphere,* Oct 28, '16. 1000 words. Illustrated.]

Examination of the remains of the Zeppelins recently destroyed reveals the details of construction, among them that for releasing bombs. The bombs are conical in shape. The base is slung in straps, and there is a strap around the neck. The latter has a releasing hook and when the releasing hook is operated the small end first drops down and the base slides out of its straps. The bomb then rights itself and drops base downward. The bombs are slung in one or two lines along the under side of the main hull. The releasing hook is operated by an electro-magnet, and there is a small switchboard in the cabin for controlling the release. Each bomb has a separate switch. The bombs can be released by hand levers also in case the electric means fail. Each bomb has a safety device and is not "alive" until it has dropped several hundred feet.

—Materiel

Germany

[Details of the Latest Zeppelin. Note. *Scientific American,* Nov 25, '16, 100 words.]

Zeppelin *L-33,* recently brought down near London, had four gondolas, and six Mercédès engines each of 240 h.p. It had five propellers, carried 2000 gallons of petrol, and had sixty bomb-droppers. The length was 680 feet, weight 50 tons, crew 22 officers and men. She carried five Maxims and two other guns.

—Naval Use of

[Zeppelins for the Navy. *Scientific American,* Jan 20, '17. 300 words.]

A moderate number of Zeppelins of the largest size would constitute a valuable auxiliary to airplanes in doing scout duty for the United States Navy. The Zeppelin has reached a size, speed, and extended radius of action which enable it to go far afield with comparative independence of the weather, and remain in designated localities for considerable periods of time before returning to its shed. The British admit that the Zeppelins have been of the greatest service to the German Navy in observing the disposition and maneuvers of the British ships.

—Rigid

[Count Zeppelin and the Evolution of the Rigid Airship. *Army & Navy Gazette,* Mar 24, '17. 1500 words.]

The idea of dirigible aerostat originated with the brothers Robert in 1784, who proposed the use of handworked propellers and a rudder, but Henry Gifford was the first man to use mechanical power, when in 1852 he built a spindle-shaped balloon equipped with a 3-h.p. engine to work the propeller. The first rigid airship was constructed by David Schwarz in Russia in 1893. It was made of aluminum and was not a success, but a similar one built to his design in Germany two years later was the first rigid airship to rise in the air and make some headway. Schwarz prepared the way for Zeppelin, who profited by his ideas and also by his errors of construction.

—Rigid—Design of

[Possible Improvements in Carrying Capacity and Speed of Rigid Airships. By C. Dornier, Count von Zeppelin's Engineer. *Aviation,* Dec 15, '16. 2100 words. Illustrated.]

Fundamental equations of the dirigible: Let V equal the available gas volume of the airship in cubic meters, s the difference in specific weights between gas and air per cubic meter, then the following expression is obtained for the weight of the ship $H = V s$ in kilograms. The net weight of the empty ship itself, $L e$, comprises the weight of the frame, outer hull, steering apparatus, gas cells, balancing planes, pontoons, structures, etc. The weight $G m$ of the machinery installation necessary for the propulsion of the ship comprises the weight of the motors and accessories, tanks and pipes, the shafting and air propellers. The amount of fuel oil necessary to drive the motor per horsepower hour may be taken as constant, and we obtain the following expression for the weight of fuel necessary to a flight of t hours: $B = kb\ Net$ in kilograms. If we substract from the lifting force the net weight of the ship, weight of the machinery installation and the weight of the necessary fuel for the required time of flight, the remainder will equal the available carrying capacity which can be utilized for passengers, crew, munitions, etc. The relation for the available carrying capacity $Nu = H - Le - Ne(Km + kbt)$ is then obtained. If the

resistance of the ship at v meters per second is equal to w kilograms, then the relation giving the necessary power for the development of such speed is

$$Ne = \frac{Wv}{75No}$$

in horsepower where the over-all efficiency of the machinery installation is No. The resistance offered by a ship in maintaining a speed of v meters per second is given by the equation $W = CV^2$ where C is a coefficient independent of the speed. We obtain therefore

$$Ne = \frac{Cv^3}{75No}$$

By putting this value of Ne in the equation, we obtain for the available carrying capacity

$$Nu = H - Le - \frac{Cv^3\,(km + kbt)}{75No}$$

On account of the far reaching value of this equation, it may be termed the fundamental equation for dirigibles. Assuming that an increase in the carrying capacity is desired where increase in the volumetric contents or gas space is not possible, the lifting force can only be increased with a constant volume by making use of a lighter gas. In the most favorable case (using a vacuum) an increase of about 7 per cent. can be obtained. Practically an increase in the carrying capacity cannot be obtained in this direction, as the net weight is not appreciably decreased. There remains only the possibility of increasing the carrying capacity of the ship without an increase in volume by a reduction in the value of the resistance coefficient. (Diagram and information are given showing the increase in speed and carrying capacity of the latter time dirigibles by improving the form.) Experience indicates that the length of the ship should always be ten times the diameter, so that when the diameter is given, the overall dimensions of the ship are definitely established. (Curves and tables are given showing the influence of an increase of overall dimensions in the area of the ship, and curve shows the increase in carrying capacity obtained by increase in the diameter.) In practice, increase in volume, perfection of the machinery installation, and reduction of the resistance coefficient go hand in hand, the only drawback being that with increase in size the cost of construction and maintenance increases very rapidly. As a result it can be safely said the airship is not at the end, but at the beginning of its development. (Diagram is given to make possible correct comparison between motor airships and airplane. This shows capacity at different speeds of large dirigible fitted up with machinery installations of various powers, compared with airplanes working with the same powered engines and at the same speed.) From this it is seen that for long voyages at medium speed the motor airship has the advantage over airplanes; on the other hand for short voyages at high speed the airplane is much superior. Conclusions of Count von Zeppelin on Dornier's paper also show that the airplane is more dependent on the condition of the machinery installation and for relatively short trips up to about 1000 kilometers, airplanes surpass the airships; but if it is a question of continuous flight of over 3000 kilometers, such as over the Atlantic Ocean, the airship is undoubtedly superior.

[Evolution of the Rigid Airship Design. By Baron L. D'Orcy. *Scientific American*, Dec 23, '16. 2800 words. Illustrated.]

Other nations than Germany are taking up the construction of rigid airships. David Schwarz, a Hungarian engineer, originated the type. Early airship frames were constructed of aluminum, but it is too brittle and has been succeeded by a zinc-aluminum alloy nearly as strong as cold-rolled steel, with only one-third of its weight.

The shape of the hull is important. Laboratory research indicates a hull six diameters long with the master diameter four-tenths of the length from the nose, of generally elliptical shape and the nose somewhat blunter than the stern. This shape is used except by the Zeppelin builders, who adhere to a length of 9 to 10 diameters, altho the later models show greater taper of the stern. The probable reason for this form in the Zeppelin lies in the greater ease of standardization of parts for cylindrical shape, and the proportion of length to diameter is necessary to conform to the sheds built.

The gangway, formerly outside, is now inside the main outline in the form of an inverted V-shaped keel, the gas cells being cut away by the necessary amount. The skin is a special fabric. Metal skin promised well in theory but leaks result from lack of absolute rigidity of the frames.

The attachment of cars and propelling apparatus becomes more difficult as the airship increases in size. The weight must be evenly distributed, hence the power units must be split up. The latest models of Zeppelins have one bow car and one stern car hung axially and two middle cars hung side by side. The three forward cars each drive a propeller aft. The stern car has two propellers mounted on the sides and driven by bevel gear. The cars are wholly enclosed.

The multiplicity of small control surfaces has given way to large monoplane surfaces which are more effective and can be made stronger. There are no swivelling or fixed propellers for direct lift. The bow car contains the "brains" of the Zeppelin. There are three compartments, a navigation room, a small wireless room, and the engine room. The defensive armament of the super-Zeppelins consists of nine machine guns, said to be of larger caliber than the ordinary small arms. Two are mounted on top forward and one aft. The rest are distributed among the cars and fire laterally.

The latest Zeppelins are said to be 755 to 787 feet long, with seven or eight engines of 1500 to 2000 aggregate h.p. The latest brought down in England was only 679 feet long.

It is definitely established that an observation car, designed to be lowered by a rope, is carried. This car

DIRIGIBLES—Continued

is stream-lined, 14 feet long, and cruciform aft to keep it head on to the resultant wind. By it an observer can be lowered several thousand feet below the Zeppelin.

—Suspended Observation Cars

[The Zeppelin Observation Car Now on Exhibition at Bunhill Fields, City Road. *Sphere,* Oct 14, '16. 200 words. Illustrated.]

(Drawing and description. A light car for a single observer, with 5000 feet of light steel cable, telephone connection and lights, is carried by a Zeppelin. This can be lowered by windlass so that the observer is below clouds which conceal the Zeppelin itself. The car is 14 feet long and weighs 122 lbs. It is stream-lined and has fins to steady it. One of these cars was cast off to lighten a damaged Zeppelin, hence the accurate description.—Ed.)

—Use of in European War

[Note. *Army & Navy Jour.,* Apr 28 ,'17. 150 words.]

Zeppelin raids have taught the Allies that, to be worth anything, sea supremacy must be completed by superiority in the air. German dirigibles are performing very important work at sea, where they are the worst enemies of British flotillas. England is building on French plans rigid dirigibles expected to excel the Zeppelins in size, speed and radius of action.

[Recent Zeppelin Raids. Quoted from various sources. *Memorial de Artillería,* Dec, '16. 850 words.]

In a little more than a week, from Sept 23 to Oct 2, the German dirigibles made three great raids over English territory, losing three units during the operations, brought down by the anti-aircraft defense. The last number of *L'Aérophile* gives some details concerning these operations.

The first raid took place during the night of Sept 23-24, it being estimated that twelve Zeppelins formed the raiding group, which is the largest known to have taken part in any expedition up to the present time.

Two of the dirigibles were brought down in the County of Essex. One fell enveloped in flames and was completely destroyed, the entire crew being lost. The other was forced to land not far from the sea on account of loss of gas. The crew, 22 officers and men, were made prisoners. Both machines were of the same type and numbered *L-32 and L-33.*

A careful examination of the *L-33* showed that it was of recent construction, and that it had been in service only since July 14, 1916. It was considered as falling within the new class of *giant-superzeppelins.* The Swiss publication, *Der Bund,* says that this new type was tried out at Friedrichshafen near the end of June. It is nearly double the size of the *superzeppelin* type and has a volume of 54,000 to 56,000 cubic meters. The principal characteristics are: length, 240 meters; four gondolas; seven propellers; 1400 horsepower; speed, 95-100 km per hour; useful cargo capacity, 15 tons; maximum altitude, 5000 meters; and crew of 30. The above characteristics coincided very closely with those of the *L-33.* The length of the latter was 205 meters, with a diameter of 21.5 meters. It carried four gondolas, with six motors (Mercédès) of 240 horse-power each, giving a total horse-power of 1400. Its volume was 56,698 cubic meters, and it carried 9000 liters of fuel. Its armament consisted of seven or eight guns, of which five were Maxim machine guns and the others of larger caliber. Sixty drop-bombs were counted.

In the raid of Sept 25-26, seven Zeppelins flew over England, and after bombarding separate and distinct districts returned uninjured to their bases.

The third raid took place during the night of Oct 1-2, and the British authorities estimate that ten dirigibles took part in it. They entered by the east coast, and some of them were able to get very close to London, being attacked by anti-aircraft guns and airplanes. One dirigible was brought down and was burned, with the loss of the crew of 19 men.

The Zeppelin brought down in this raid was the *L-31,* and the experts decided that it had been in service for about one month. For this reason the data concerning this dirigible taken from *L'Aérophile* are of interest. These are:

The envelope is fusiform of about 205 meters in length. Its diameter is 21 meters at its greatest section, which is about 20 meters from the bow, tapering to about 7 meters near the stern and ending in a sharp point. The metal used in the framework is an aluminum alloy. The gondolas are four in number and made of metal. Two carry Mercédès motors of 240 horse-power, which actuate thru reducing gear, two propellers of 6 meters diameter. Another motor is located in the third gondola, and in the fourth are located three others. These transmit the power to the propellers thru very large shafts, which are arranged so as to reduce vibration. The total power is 1400 horse power. In the forward gondola is located the conning tower, with apparatus for the transmission of orders similar to that used on board ship. The bomb-dropping device is controlled from this gondola. The armament, consisting of machine guns, is distributed among the gondolas, and a platform is provided for a gun of larger caliber.

DISCIPLINE

See also

Infantry—Instruction and training

[Doctrinal Drills and the European War. By Lieut. Col. F. J. Diaz, General Staff. *Mem. del Ejército* (Chile), Dec, '16. 1330 words.]

In order that every commander and every soldier may thoroly assimilate the forms and established principles which tend to victory, it is necessary that the army follow closely the evolution which the tactics of the three arms undergoes as a result of the practical experience gained on the battlefield. The lessons taught during the war of 1870-71 were adopted by the Germans 18 years later, being incorporated in the 1888 Regulations. These same regulations were adopted in 1895 for the Chilean Army; thereby estab-

lishing a new era in the instruction of its infantry. The present war has demonstrated the soundness of the existing principles.

The training of troops for war does not stop with their behavior on the battlefield. It is necessary that they learn the principles of marching and of camping.

The only solid basis of discipline is the rigid observance of adopted principles, and drills executed with the strictest precision.

The school of doctrinal drills consists, above all, in a methodical and careful individual training in all the elementary movements, position of the soldier, marchings, facings, manual of arms, as well as a precise and energetic execution of the company movements, in close and extended order.

Von Freytag-Loringhoven, Assistant Chief of the German Great General Staff, states that in the present war well disciplined troops have known how to maintain the positions in which they have been placed. On the other hand, it is a fact that untrained troops have failed, not because of the lack of instruction in target practice, and of adaptability to extended order formations, as was the case with the Boers, but because they lacked discipline—drill—which converts them into an effective weapon in the hands of the commander-in-chief. This cohesion can be obtained only by the precision taught on the drill ground. The French, who heretofore have generally been opposed to details of military precision, are recognizing in the present war the importance of doctrinal drills and of disciplinary exercises.

Captain André Laffargue, of the General Staff, wounded five times, and who has been decorated with the Legion of Honor and with the Military Medal, has made the following remarks with reference to the infantry attack:

Advance to the assault.—All the men of a given echelon leave the trench at the same time and start at a walk. It is astonishing to see the influence which this step, energetic and in cadence, has in bringing about perfect ease and an absolute disregard for the adversary. Instinctively, in the French attack of Neuville-Saint Vaast, all the troops advanced at quick time.

Alignment.—To keep an alignment while marching to the assault is a matter of supreme importance. One must see the importance of this alignment during the tragic moments of the assault in order to understand its wonderful influence. Those who regarded as childish and as a waste of time the drills in the manual of arms and other exercises intended to develop to the full capacity the absolute discipline of the soldier, will have to acknowledge their error. Now we see that with the troops at the front advantage is taken of every available opportunity to discipline the men by means of old drills which the civilian element regard as ridiculous. In the alignment, each man maintains his place, draws along those who are timid, and gives to others a feeling of mutual confidence. At Neuville-Saint Vaast, the French advanced at first in quick time, then at double time, maintaining an alignment as if on parade.

Quoting from a Captain of Chasseurs whose name has been mentioned several times in the order of the day:

"The war has proved that a skillful handling of the weapon brings on victory. Combat exercises with complete units, something heretofore neglected by the French because they regarded the squad as the only combat unit, close order drills and the review which should always follow every drill, contribute to develop the feeling which is apt to disappear while in the trenches."

[Psychology of Subordination. By Dr. Marcos. *Memorial de Caballería,* May, '17. 2000 words.]

Discipline is military economy. Its most ostensible phase is subordination. Economy signifies the attainment of maximum results with the minimum of force. In ordinary affairs economy is advisable and convenient; in military affairs it is indispensable. The labor of implanting discipline should be started during childhood. In the military service it is instilled in the academies, the schools for officers, and in the regiments, which are but schools for non-commissioned officers and soldiers. Discipline is manifested objectively or externally and subjectively or psychologically. The former manifestation shows in the attitude before superiors, in taking the position of the soldier, saluting, etc. The latter in the manner of receiving and of giving orders, treatment of inferiors and in general all conversations between military men of distinct grades.

Discipline is attained thru the moral military education of the soldier. It is incumbent upon all individuals in the service sedulously to assist in its cultivation.

[Leadership. Discipline and Contentment. By Lt.-Col. G. Van Orden, U.S.M.C. *The Marine Corps Gazette,* June, '17. 4500 words.]

(Remarks on the qualities a leader should have, such as courtesy, good sense, ability to awaken the interest of one's men, justice, loyalty; and on what constitutes real discipline.)

DISCIPLINARY BARRACKS

[The United States Disciplinary Barracks. By Capt. Harrison S. Kerrick, C. A. C. *Journal Military Service Institution,* Nov-Dec, '16. 5000 words. Photographs and diagrams.]

(The article covers thoroly the history, methods and results of this phase of "Prison Reforms.")

DISEASES

See
Measles
Sanitary service
Shell-shock
Trench-foot
Tuberculosis

DISINFECTION

See

Sanitary service—Preventive measures—Disinfection

DOCKS AND WHARVES

[Mechanical Appliances in British Dockyards During the Last Great War. 1800-1815. By Commander Lord Teignmouth, R.N.Z. (retired). *United Service Magazine*, May, '17. 6000 words.]

(A complete history of the dockyards during the period 1800-1815.)

DOGS

[War Dogs. *Memorial del Ejército de Chile*, Sept, '17. 175 words.]

Dogs are now used extensively on the war fronts in Europe. Their most frequent employment is as follows:

(a) In the Red Cross Service to search for wounded.

(b) To assist sentinels on post in the trenches.

(c) To carry ammunition to parts of the line under heavy fire.

(d) As guards in camps of concentration.

Their use has been of appreciable value in permitting a reduction in the number of sentinels required to guard the thousands of prisoners assembled in these camps.

—Sanitary Service

[Military Dogs. By Captain E. C. Jones, Medical Corps, U. S. Army. *Military Surgeon*, Apr, '17. 3000 words.]

The use of dogs for military purposes has been neglected in the United States. With Japan and China, the United States is the only large nation where the government has accomplished nothing in developing the military dog.

Germany has gone farther in this development than any other nation. The work was begun in 1885; in 1890 two trained dogs were assigned to a battalion of the Guard, and these were the first official dogs of the sanitary service. As a result of their efforts, of which this was the first, the Germans had over two thousand dogs at the beginning of the present war. So valuable were their services that the Germans established a dog hospital, where all wounded and sick dogs are sent for treatment.

France became interested in the subject about 1895, but it was not until 1908 that the French Red Cross gave this work any support. Accordingly, at the beginning of the present war, France had only fifty trained dogs and fifty in training.

It is impossible to estimate the number of lives that might have been saved had trained dogs been used in past wars. However this may be, there can be no longer any question as to their value: for example, in December, 1915, more than eight hundred wounded men are known to have been saved by dogs in the German military service after the search for them had been abandoned by the litter-bearers. In modern warfare the removal of the wounded from the battle field is a serious and difficult problem. In most instances the work of looking for them must be done by night, when the use of lights for this purpose is impracticable; and without the use of lights to find all of the wounded by litter-bearers is an impossibility. It is just here that the trained dog is most useful.

Before the present war in Europe, definite schedules were followed in dog-training and hours in instruction given precisely as in the training of recruits. The progress of their training and its completion had to be decided by examination, and these examinations were held in the presence of the battalion commander, and the results filed with the dog's descriptive card. After being trained, dogs were assigned to a battalion and were required to accompany it in all field exercises; battalion commanders were required to see that the dogs for outpost duty, messenger duty and sanitary duty were kept busy during the field exercises. Sanitary dogs were taught, on finding the wounded, to make this fact known to the litter-bearers in one of three ways: (a) remain with the wounded man and attract attention by barking; (b) return to the litter-bearer and bark and then lead the litter-bearer to the wounded man; (c) carry some aricle, such as a hat or a handkerchief or any part of the wounded man's equipment to the litter-bearer and then lead him to the wounded man. The first two methods have been abandoned because they attract the attention of the enemy; the third is not only the best, but the easiest to be learned by the dog.

Most of the dogs used in the German army are the German sheep-dog, altho some Belgian sheep-dogs and some bird-dogs are also used. France uses the same animals and also English hounds, collies and airedales. The German sheep-dog, if of pure breed, is unquestionably the best for military purposes.

In the spring of 1916 an offer was made to the War Department by two Pennsylvanians to develop dog-training in this country for the benefit of the army. This offer was rejected.

DONIPHAN EXPEDITION (1847)

[A Chapter From the Doniphan Expedition of 1847. *Jour. U. S. Cav. Assn.*, Jan, '17. 6000 words. 1 sketch map.]

(A description of a remarkable expedition comprising fewer than 1000 men under Col. A. W. Doniphan, 1st Missouri Cavalry, against the City of Chihuahua. Tremendous changes have occurred in the interval between the Doniphan and Pershing expeditions; but one element—the Mexican people—has undergone little change. The article is principally of historical interest. The description is taken from a rare book, now out of print, written in 1847 by John T. Hughes, who was a trooper in Doniphan's command.)

DRILL REGULATIONS

See also

Cavalry—Drill regulations

EDUCATION, Military

See

Aeronautics—Instruction and training

Artillery—Instruction and training

CAVALRY—FIRE—INSTRUCTION AND TRAINING
CAVALRY—INSTRUCTION AND TRAINING—SCHOOLS
DIARIES
FIELD ARTILLERY—INSTRUCTION AND TRAINING
INFANTRY—FIRE—INSTRUCTION AND TRAINING
INFANTRY—INSTRUCTION AND TRAINING
MOBILE FORCES—INSTRUCTION AND TRAINING
OFFICERS—INSTRUCTION AND TRAINING OF (IN GENERAL)
SIEGE OPERATIONS—INSTRUCTION AND TRAINING
SWIMMING—INSTRUCTION AND TRAINING
TRAINING CAMPS
WOUNDED—INSTRUCTION AND TRAINING OF

[Suggestions for the Conduct of Instruction. By Dr. Teófilo Gatica. *Revista Militar,* Jan '17. 5500 words.]

The object of military instruction is to give the soldier a sound theoretical and practical preparation for war, and so to form his will that he will endeavor with all his heart thoroly to accomplish any mission assigned him.

Each soldier is a potency that must function not mechanically, but under the fullest development of individual initiative.

The task of the military instructor is to educate men physically, intellectually and morally. The results attained depend upon the capability and skill of the instructors and upon their knowledge of the mechanism of teaching.

Military instruction must procure ultimately that the soldier march, reconnoiter, encamp, deploy, advance, take cover, load, discover the target, set the sights, aim and fire without conscious volition in the same way that one instinctively draws back from the edge of a precipice or throws out his hands to avoid injury when falling.

Instruction should not tend to repress the soldier, but should favor the development of individuality and initiative. The army does not need automata. It needs active, energetic and intelligent men.

All teaching is governed by the principles that the individual learns only that which he can understand, and understands only that which is repeated and is within the range of his intelligence.

Repetition is the *nerve* of military instruction. The following method of repetition is recommended:

An exercise, having been demonstrated by the instructor and practiced individually by the men, is repeated from 3 to 10 times, depending upon its nature. The instructor then permits the men to practice it at will, taking care that their minds and bodies do not become unduly fatigued. The exercise is repeated on the afternoon of the same day or on the following morning 4 or 5 times, then a day or two is allowed to pass and it is again repeated several times. Afterwards the intervals between repetitions are greater. It is impossible to give fixed rules for the intervals and opportuneness of the repetitions; however, it is possible to establish the following criterion: *Repeat little at a time, but many times during the year.* Make frequent reviews of fundamental principles. *Man knows only what he can remember.*

[Suggestion for Conducting Military Instruction. By Dr. T. I. Gatica, Auditor of War. *Rev. del Círculo Militar,* Mar, '17. 5000 words.]

Military training has for its purpose a thoro preparation, theoretical and practical, of the soldier for war, and the development of an energetic, intelligent, and disciplined will.

The task of the instructor is to educate the man physically, mentally, and morally. The results attained will depend upon the skill of the instructor and upon a knowledge of the mechanism of teaching.

To be of value, the instruction given to the soldier must be so incorporated into his being that he responds to command and performs his routine duties without conscious effort of will, his mental faculties being free for other uses.

This does not mean that the soldier is to be converted into a machine; on the contrary, his training should tend to develop his intelligence and initiative. Each recruit must be recognized as an individual possessing his special qualities and characteristics which cannot be changed, but which may be modified to meet the requirements of the military life.

In order that an idea may be assimilated, it is essential that it be linked up with ideas or associations already established; otherwise it remains "in the air" and is soon forgotten. The individual only truly learns what he understands and can only understand what is within the reach of his intelligence.

Instruction must proceed slowly, being limited on each occasion to what the recruit can readily assimilate. It should also be active, employing the body muscles and faculties, remembering that the training is not a matter of acquiring ideas so much as of developing habits.

Repetition is the basis of all training; a man only learns to march by marching; to shoot, by shooting. Repetition develops the aptitude of an organ and strengthens it so that each execution of an exercise is performed more smoothly and easily than the last.

The form of the repetition is important; the same words should be used in conveying the idea or command and the elements of the exercise should follow in the same sequence. The process is similar to the growth of a path thru a field; many feet must follow the same line and tread in the same tracks before the path is established.

Repetition is most efficacious when it takes place at intervals. The exercise should not be practised too much at one time. The rule should be: Repeat a few times on each occasion, but repeat often during the year.

The success of military instruction will depend in great measure on a properly arranged and progressive schedule; the instructor should calculate in advance the time available for each subject, fix the date on which he will take it up, the duration of each period, and the interval between periods. A daily schedule should also be prepared fixing a definite moment when each exercise would be terminated and the next one taken up, periods of rest, etc. Nothing should be left to chance or the impression of the moment.

EDUCATION, Military—Continued

Before beginning new work, the exercises of similar character practised on a previous occasion should be gone over rapidly to establish a link in the chain. The instructor should explain the new exercise in the fewest possible words and execute it several times. The men should then be required to execute it following the movement of the instructor. While executing the movement the recruit should be required to repeat the command to fix the association of ideas in his mind.

Theoretical instruction should follow the same line as practical work, but unfortunately owing to the lack of instructors this will rarely be possible and instead of a maximum of twenty, the classes will more often be sixty or seventy, and most of these will be absent in spirit tho present in body.

Theoretical work being less fatiguing than practical, the periods may be longer, but should never exceed forty minutes.

The first fifteen minutes should be given to a review of the work of the previous session. The next fifteen minutes should be devoted to setting forth clearly, concisely, and in terms easily understood by all, the matter contained in the new lesson, and this should be connected up with what has gone before or with facts known to all the recruits. The next ten minutes should be occupied in questioning the recruits to confirm their understanding of the instruction given and to clear up any doubtful points.

Germany

[Preparatory Military Training for the Young Men in Germany. *Kungl. Krigsvetenskaps-akademien's Handlingar och Tidskrift.* (Proceedings and Journal of the Royal Academy of the Science of War), Jan, '17. 2350 words.]

At the outbreak of the present world war, a great many German youths volunteered for service, but many thousand of them were rejected either on account of their being too young or because of lack of physical strength. It was, however, important that their enthusiasm and love of country should not cool, and therefore as early as Aug 16, 1914, the German Minister of War issued instructions for the military training of young men during the war.

This preliminary training without arms was to serve as a preparatory school for youths of 16 and over to train them for service in the army and navy. In this training (education) of the young men, special stress was laid on the cultivation of their love of country, their courage and resolution and their devotion to the emperor and to the German Empire was to be stimulated by thoughts of the unparalleled danger which overhangs Germany. It should be made clear to them that Germany goes under if it is not victorious. It *must* conquer, and every individual defender of the Fatherland, even the youngest, must carry in his heart the firm and resolute will that it shall be victorious. Martial qualities should be fostered and developed in the youths, and their physical condition strengthened.

The work of training the young men should as much as possible be done under the direction of the department having charge of the care of youths, which is supported by the state. The youths are divided into comradeships, platoons and companies, a company consisting of about 100 men. During week days the training takes place in the separate schools or at the works that the men attend, but on Sundays it is important that youths of all classes in the community should stand shoulder to shoulder and be trained together.

Each one who takes part in this training is called *Jungmann,* and the companies are numbered from one up continuously, with the district sometimes added.

Die Jungmannschaften are entered in a roll containing the headings: full name, birthday and birthplace, trade, which school and class, time when enrolled, sick from —— to, dereliction of duty, conduct, left the ——and where to, and a column of remarks showing special qualifications. The *Jungmann* binds himself to attend the trainings regularly, to obey his leaders, to conduct himself worthily, and be a good comrade. The times when the exercises take place depend on personal and local conditions. Overexertion should be carefully avoided. The Sunday exercises to be so arranged as not to interfere with attendance on church services, and the men should not be taken away from their families too much.

The need of suitable leaders is especially important, and classes for their training are to be organized.

As an insignia of membership, each *Jungmann* is to wear on his left sleeve (and every leader if not in uniform) a band in the national colors, showing the number of his company. In Brandenburg and Berlin the band has on it the Prussian eagle. The companies have the right to wear a special uniform, but this must not be like that of the army and must have no rank insignia.

Before admission into these young men's companies, each one should, if possible, be given a medical examination in order to exclude those not physically fit and those whose health would be endangered by the exercises, this examination to be similar to that given a man before his entry into the military service, special attention to be given to the condition of the heart.

Instructions relative to food, clothing, cleanliness, sleep, conduct during marches, care of feet, and means taken to guard against the influences of the weather, are all given in detail.

The training is to consist of such preliminary military instruction as can be given without arms, such as drill in close and open order, estimation of distances, gymnastic exercises (climbing, running, etc.), signaling and field service, such as simple patrol, reconnaissance, etc.

The exercises and instructions should be given with life and in a manner to attract the young minds. They should tend to bring out a natural and unaffected manner, sharpen their powers of observation and instill in them a military bearing. The youths should be urged to carefully and exactly repeat instructions given them, to give quick and clear answers, and to show willing-

ness and obedience. Punctuality, conscientiousness, reliability, sense of responsibility and independence are absolutely required.

Additional training in the rudiments of drill and target practice can be given if time allows.

—In Public Schools

[Personal Views on a Comparison of Military Education in the Ordinary Schools of America and the Schools of Japan. By Ichihei Kato, Lieut. of Infantry. *Kaikosha Kiji,* May, '16. 3500 words.]

(Index—Two main chapters with six and five subdivisions respectively. General introduction, discussing the changes of the laws of war, the broadening of the field of battle, and the changes in the equipment of modern armies.

Chapter one, section one, deals with the general subject of military education in the ordinary schools of America. Section two deals with the history of same. Section three with the opinion of Americans regarding the question of military education in schools. Another section with inspections and still another with the true condition of such military education. This latter goes in detail into the system in the various states of the United States, and is a very long and minute study. The article is continued in the next number of this magazine.)

[Personal Views on a Comparison of Military Education in the Ordinary Schools of America and the Schools of Japan. By Ichihei Kato, Lieut. of Infantry. *Kaikosha Kiji,* June, '16. 3000 words. Several tables of statistics.]

(A continued article from the May number of this magazine. In this number are the concluding sections of Chapter one and all the sections of Chapter two. The article is concluded. There are many headings and subheadings and the study is a very minute one.)

—In Schools and Colleges

[Military Instruction in the Universities of the United States. By Major A. Ewing, Chilean Army. *Mem. del Ejército* (Chile), Jan, '17, 800 words.]

(A brief sketch in which are discussed the steps adopted to establish at all universities a course in military training. This is a measure which not only develops the national defense of the country, but tends to educate the future legislators of the nation, who, when military legislation is being discussed, will be in a position to appreciate the needs of the army and navy.)

[Our Land Grant Colleges as a Military Asset. By Edward Orton, Jr. (Ohio State University). *National Service,* June, '17. 2500 words.]

In 1862, during the stress of civil war, there was passed the Morrill Act, granting lands to the several states to be administered by them for the purpose of maintaining institutions of learning. The Morrill Act "without excluding other scientific and classical studies, and including military tactics" required the teaching of agriculture and mechanic arts.

The requirement of military instruction is of principal importance in the present connection. Over this instruction the War Department had no specific control and hence no direct interest in it. Detail of army officers as instructors was authorized by law. By the withdrawal or refusal of such instructors, the War Department could at least exercise pressure to cause the land grant colleges to meet its requirements. Any school so treated could of course go ahead with other instructors, but good sense prevailed and a minimum course was adopted.

During fifty years, many thousand students have been trained at these colleges. Approximately 30,000 are now annually under instruction. The worst result of the lack of control of this military instruction by the War Department has been the failure to take advantage of the trained product of the system. Ten men annually may be given commissions in the regular army, but this number is insignificant among the thousands. The result has been a sense of the futility of the instruction, and has minimized its value. If the men could have gone into a reserve corps, a reserve of great value would have been created. Of particular value would have been those men who voluntarily continued their military instruction in the grade of cadet officers.

The officers' reserve corps and the reserve officers training corps afford an opportunity for connecting the land grant colleges with the military service, and will make the military drill a logical step toward an attractive goal instead of a useless expenditure of energy and a meaningless form.

[College Courses for War Service. *Army & Navy Jour.,* July 28, '17. 700 words.]

Columbia University is conducting a special course approved by the Secretary of War and the War College for military interpreters. Students must possess a fluent speaking and reading knowledge of French or German. The U. S. Army physical standard, except minor defects, is exacted. Citizenship and loyalty are carefully investigated. The course began July 11 and will end Aug 17.

Eight hundred students at the Universities of Illinois, Wisconsin, Pennsylvania, Chicago, at Pennsylvania State College, Harvard and Dartmouth, are taking a preparatory course to fit them for ordnance work. Each course is of six weeks' duration. After completion of this course, the student is sent to an arsenal for a higher course of training. Watertown, Rock Island, Augusta and San Antonio arsenals have been designated for the higher training.

["Preparatory Military Instruction in Other Countries. Methods That Should Be Adopted in Chile." By Capt. G. *Memorial del Ejercito de Chile,* Aug, '17. 3800 words.]

(A brief description is given of the preparatory military instruction given school children in Germany, France, Sweden, Denmark, Switzerland, United States, Argentine Republic,. Brazil, Peru and Chile. The conclusions are):

EDUCATION, Military—Continued

1. That military instruction should be given in Normal Schools, in order to secure instructors for civic and military education of youths.

2. That target practice should be introduced in all schools. This would be exceedingly efficacious in preparatory military instruction.

3. To give instruction in National History in the schools, and to instill patriotism to the end that the youth of the nation may learn National History and at the same time appreciate the importance that the armed institutions bear in the progress and development of the country.

4. To foment the development of Boy Scout Organizations, as these form an excellent preparatory school for military service.

5. To establish military instruction in the School of Arts & Sciences, and in Agricultural Schools, in order to secure Subaltern Officers for the Reserve.

6. To favor the organization of gymnastic societies and other similar institutions that contribute to the physical development of youths.

7. To organize schools of nurses in the Normal Schools for the purpose of preparing a sufficient personnel for the Red Cross Society.

South America

[Spain and America. *Memorial de Caballería.* Jan, '17. 500 words.]

In a letter to the editor, published under the above heading, Capt. Zárate of the Peruvian army urges that distinguished military writers of Spain contribute copies of their works for transmission to the General Staffs of Peru, Bolivia and Ecuador. Some 200 volumes have already been contributed. The plan is to bring about a closer professional relationship and understanding between Spanish and Latin-American military officers.

—Teaching Personnel

[Educational and Didactical Personnel. By A. de Quinto. *Memorial de Caballería,* Dec, '16. 1800 words.]

The most efficient armies of the world belong to those states having forceful and inspired corps of officers. The great work of producing trained and educated officers, capable in turn of training and educating soldiers, falls upon the professors at the military academies. To quote von der Goltz, military professors must belong to the intellectual and moral aristocracy of the nation.

The synthesis of the educator of cadets is to form character, strengthen the will, develop the intelligence, instill discipline, improve the physique, awaken enthusiasm, and implant and cultivate ideas of duty and power.

It is evident that natural gifts are indispensable to enable the professor to accomplish his high and noble obligation as *educator of future educators.*

ELECTRICITY IN WAR

See also
RECTIFIERS, CURRENT
WOUNDS—TREATMENT OF

EMBARKATION

See
LANDING OPERATIONS

"EMDEN," Operations of the

[*Emden.* By Lieut. Hellmuth von Mucke. *Proc. U. S. Naval Institute,* July-Aug, '16. 5000 words.]

(The *Emden's* last days make an interesting story; one dealing with the attempted disabling of the cable station at Keeling Island and the naval duel between the *Sydney* and the *Emden* resulting in the destruction of the latter.)

ENCAMPMENTS

See also
BILLETING
TRAINING CAMPS

ENGINEERS

See also
ENTRENCHMENTS
EUROPEAN WAR—ENGINEERING OPERATIONS IN
FORTIFICATIONS

United States

See
UNITED STATES—ARMY—ENGINEERS

—Engineer Troops

See also
RAILROAD TROOPS

—Field Operations

See also
BRIDGES, MILITARY
ENTRENCHMENTS
RAILROADS—CONSTRUCTION AND REPAIR IN WAR
SAPPING AND MINING
SOMME, BATTLE OF THE—ENGINEERING OPERATIONS
WATER SUPPLY

[The Work of Engineers. By Major Diaz de Vivar. *Revista Militar,* Aug, '16. 3500 words. 7 photographic illustrations.]

The passage of water courses is included in the work of the engineers during the battalion and maneuver periods. The bridges to be constructed by military engineers in Argentina would probably average 190 meters in length. The use of improvised materials is recommended, this in order to approximate campaign conditions. (The data are given which refer to the construction during the recent maneuver period of three bridges, of which two were pile and pontoon bridges for the use of supply columns, and one a suspension bridge for foot troops.)

[A Useful Anchor. By Lieut.-Col. Bertram A. G. Shelley, R.E. *Royal Engineers Journal,* May, '17. 200 words. Illustrated.]

(A brief description of a specially fabricated device to be used as a deadman for holding revetments, staying poles, or for similar purposes.)

—History

Great Britain

[Deeds of the Royal Engineers. Chapters I and II. Compiled in the R. E. Record Office. *Royal Engineers' Journal,* Feb, '17. 4800 words.]

(Historical. Chapter I gives a short history of military engineers in England from the days of William the Conqueror to the present day. Chapter II treats of the engineer work in the siege of Gibraltar by the Spaniards in 1779-1783. To be continued.)

[Deeds of the Royal Engineers. Chapter III. Compiled in the R. E. Record Office. *Royal Engineers' Journal,* Mar, '17. 1800 words.]

(Continued from *R. E. Journal,* Feb, '17. Historical. This chapter covers the work of engineer officers at Waterloo, treating principally of the history of the map of the field prepared by engineer officers and used by the Duke of Wellington. To be continued.)

[Deeds of the Royal Engineers. Chapter IV. Compiled in the R. E. Record Office. *Royal Engineers' Journal,* Apr, '17. 9000 words.]

(Continued from *R. E. Journal,* Mar, '17.)

(Historical. Chapter IV is an account of the exploits of the British engineers in the Crimean War. To be continued.)

[Deeds of the Royal Engineers. Compiled in the Royal Engineers Record Office. *Royal Engineers Journal,* May, '17. 5700 words.]

(Continued from the April number of *R. E. Journal.*)

(Historical. Chapter V describes briefly the work of the engineers at the siege of Delhi in the Sepoy Mutiny in India in 1857, and more particularly the blowing in of the Kashmir Gate when Delhi was stormed. Chapter VI gives an account of the operations of the 23rd Company, Royal Engineers, in the Indian Mutiny and in China from 1857 to 1860.)

—Instruction and Training

[Practical School of the First Regiment of Engineers. By Manuel de las Rivas. *Memorial de Ingenieros del Ejército,* Apr, '17. 11,000 words. Sketches and photographs.]

(A description of the work done by the above regiment in fortifications and bridge building. Contains nothing new.)

—Permanent Operations

See also

Docks and wharves
Fortress engineering
Water supply

ENCAMPMENTS

[Concerning the Method of Carrying into Effect the Occupation of Night Camps. A compilation from the lectures of Captain of Engineers Hiraoka, delivered at the maneuvers of the 23rd Infantry Bridgade. *Kaikosha Kiji,* June, '16. 1000 words.]

[European war, Echoes of. Trenches. By Jose Paulo Fernandes, Capt. of Artillery. *Revista de Artilharia,* Nov, '16. 2700 words. To be continued.]

(A general historical and descriptive article on the use of trenches.)

ENLISTMENT

See also

Recruiting

ENTRENCHMENTS

See also

Patrols—In trench warfare
"Trench-foot"

[A Few Points of View of the Present Trench Warfare. By O. v. P. *Tidskrift i Fortification,* parts 3 and 4, '16. 2600 words.]

This world-war has produced many surprises with respect to the value of some of the military views that were generally accepted before the war.

Thus not only must the principles governing the construction of permanent fortifications be subjected to a thoro investigation and revision, but also in the construction of field works new factors have developed that greatly influence the subject.

As soon as the teachings that the experience gained in this war shall have been thoroly studied then these problems can be satisfactorily solved, but until then only partially so.

After the battle of the Marne, the war on the western front developed into position, or trench warfare, in many respects very much like fortress warfare. The cause of the introduction of this method of warfare by the Germans at this time seems to have been their exhaustion after the extraordinary forced marches towards Paris and also possibly to the necessity of employing some of their troops on the eastern front. At any rate the defense had by this time developed a strength that the offensive-loving Germans had not suspected and they had to resort to defensive trench warfare.

A change has taken place in the relative importance of the different arms and a new arm, the flying arm, has taken the place of the cavalry for gaining information of the enemy's position and movements, which the cavalry can no longer do in this trench warfare.

It has been found impossible for the infantry to break thru a carefully prepared position protected by wire entanglements without the assistance of powerful artillery fire. This has given rise to the exaggerated statement that this world-war is decided in the munition factories. It is certain that unless the obstacles and trenches are overwhelmed by fire from heavy as well as light artillery, the infantry has little chance to succeed in capturing the position, but the preparation for this in any sector, collecting and placing in position the large artillery force with its huge amount of ammunition, takes time and allows the opposing force also time to prepare for it. This has given rise to the construction of several lines of trenches, so that if the first line is destroyed by artillery fire there will be a second and a third line from which a counter-attack can be made.

It has developed that three lines of trenches form the first or advance *defensive position.* A second defensive position similar to the first is also constructed where it is deemed necessary, which is especially de-

ENTRENCHMENTS—Continued

signed to strengthen the tactically important points. The artillery is grouped to protect the advance position as well as to reach the enemy's line. The distance between the two positions depends somewhat upon the lie of the ground, and also on the principle that it will be necessary for the enemy's artillery to change its position after destroying the advance position, before it can attack the second. In some cases it has been found necessary, and when time has permitted, to construct a third or even a fourth defensive position. A fully constructed defensive position consists usually of three lines of trenches; the advance trench, which is the observation and fire trench, and in front of which is the obstacle consisting usually of barbed wire entanglements; the second serving as a rallying line and a communication trench, with the third at or near which the reserves are located. Behind and near this are the broader covered roads or passages along the rear of the whole front; these also lead to the positions from which flanking fire by machine guns is delivered. In addition to this, bombproof shelters for offices, for the men to rest in, first aid stations, etc., are constructed. The line is also often divided into sections, separated from each other by obstacles, so that an enemy that gets into one section is subjected to fire from both sides. The lines must also be masked as much as possible, not only from the front but also from the air, and this has led to another departure from the old maxim that the firing line should have unobstructed view to the front for a long distance. It can in that case be more readily located by the enemy.

The front trench should also be located further down the slope of a hill and not on the military crest with advanced positions for machine guns. The main communications should be constructed behind the crest. The second line should, if practicable, be constructed just behind the crest where it cannot be destroyed by the artillery fire that destroys the advance position. Experience has taught that the obstacle should be located near enough to the front trench to allow hand-grenades to be thrown at an enemy trying to pass it; on the other hand some think that the obstacle should be located so far in front of the advance trench that the enemy cannot throw bombs from it into the trench, since the enemy can always be reached by musketry fire. The obstacle should also, if possible, be masked so that it cannot be destroyed by artillery fire, and also flanked by machine gun fire. Since the infantry fire in position warfare is at such short ranges, it has become necessary to have head protection by means of steel shields, small embrasures, portholes, etc. In order to afford protection from the high angle fire of howitzers, the trenches must be as narrow as possible, from 1 to 1½ m. wide, with vertical walls. This makes it very difficult to carry the wounded thru them. Bombproof shelters are also constructed for offices and living rooms, and it is very essential that these rooms should have more than one entrance, since one of these might be blocked up by the explosion of a shell or otherwise, and if there were no other exit, the men in it would be entombed.

It has been ascertained that for the defense of the first line a company suffices for a front of 600 to 1200 m. Behind this front there must be at least twice this strength and besides this, reserves are necessary at certain points to be used in counter-attacks.

As the two opposing lines are in a similar condition and attitude toward each other, the same conditions apply to both and both must attack as well as defend in order to succeed. Since the front opposing lines are so near each other, it follows that no portion of the line can be left to be defended by obstacles or artillery and machine gun fire alone but there must be infantry along the whole line.

[More German Trench Wonders. *Canadian Military Gazette,* Nov 14, '16. 600 words.]

Some of the German communicating trenches and dugouts revealed by the British advance in the Somme sector are really remarkable for their military value. One of these trenches was a tunnel, over 100 yards long, lined with timber and so far underground as to be safe from every attack except mining.

The larger dugouts are entered thru a steel door, from which there is a 30 foot staircase. At the bottom of the stairs were found spacious rooms in which the floors, walls and roofs were closely boarded. The connecting passages were equally well finished and a second 30 foot staircase leads down to another similar group of rooms. In one dugout which was being extended at time of capture was found a device for sending up the excavated earth, packed in bags and ready for use in the trench above. Another was arranged as a hospital, to care for 30 persons, and equipped with two tiers of bunks.

The Germans also go to a great deal of trouble to provide effective posts for snipers. A typical post, near Fricourt, is the mouth of a small, deep manhole. It reaches the surface near the highest point of a piece of high ground, the opening is carefully screened by casual-looking debris and at the bottom of the manhole a tunnel connects it with the German trenches.

[Big Gun *versus* Dugout. *Scientific American,* Dec 23, '16. 125 words.]

The big gun has forced troops far under ground. Formerly a six-foot trench gave sufficient protection. But the big howitzer, using high explosive shell, has made such protection useless, and the defenders go deep down. The British attacks have revealed German dugouts twenty to thirty feet below the surface.

[What's New in Intrenching? By Acer. *Military Historian & Economist,* Jan, '17. 3500 words.]

(This article is based on "Spade Warfare," a book published in Berlin, in 1916, by E. S. Mittler & Son.)

In garrison it was very hard to get the spade on the man for it was an unwelcome load and every one avoided carrying it. But in campaign the spade is the most important weapon of protection. By its aid the soldier overcomes two great enemies—the heavy guns, and the cold and damp.

Construction of Rain and Shrapnel Proof Shelters

The Germans realize that the time has gone when a battle can be decided in one day. Many months must pass before a decision can be reached. They therefore establish themselves in strong bomb proofs as if for a definite stay, and when they move they take along on the tool wagon whatever may be serviceable and the next time build better than before.

Constructing Approaches and Rifle Trenches

By the use of the spade in constructing approaches and rifle trenches the attacking line can be pushed forward further and further.

After dark, pioneers follow the patrols to the front, test the ground and determine where a new trench can be successfully dug and a new "village" excavated. Then follow the men who begin to dig, one party on the main works, another on the ziz-zag connecting trenches. In this way the advance is made on the enemy's trenches; but upon arriving at from 100 to 40 meters of the enemy, the work must be crowned with a surprise attack in order to make him vacate his position. Sometimes, however, he is so well intrenched that even the short distance of 50 meters can not be crossed without great sacrifices. The English, in particular, have covered their positions with steel plates, electrically charged their wire entanglements and so barricaded themselves that it is almost impossible to reach their positions.

The Spade in the Assault

Even in the assault the spade is the most important weapon of protection. The rifle can only be used to a limited extent for only the first line can fire. The supports, however, begin to intrench as soon as they halt and these shallow trenches are always deepened by the lines of men who follow. When the ground is frozen the spade handle is stuck under the knapsack so that the metal covers the head. The knapsack protects the back to some extent and thus the two most important parts of the body receive some protection.

Spade Work as a Means of Preserving Health

By work with the spade the soldier preserves his health of body and activity of mind and he is urged to keep constantly improving his position, fitting it into the terrain, covering it with sod, planting it with bushes, etc., in order to deceive the enemy's aviators. He is taught from the beginning that the spade must win over the shells for it is the key to the enemy's position, and that its use will preserve his health and enthusiasm.

(To be continued)

[What's New in Intrenching? (Concluded.) By Acer. *Military Historian and Economist*, Apr '17. 8000 words. Figures and diagrams.]

1. *Location of the Position*

Places easily recognized, such as roads, edges of woods, hedges, clumps of trees, etc., must be avoided. Trenches near a metalled road must be placed on the enemy's side; otherwise bullets striking the hard road-bed are deflected and deformed and inflict ugly wounds.

Irregularity of trace is essential, and it is of prime importance that every part of the front can be swept by a flanking fire. Machine guns are well adapted for such fire.

The present type trench differs from the older one in that the traverses have been strengthened and the distances between shortened. This strengthening was necessary in order to furnish cover against oblique and enfilade fire. These broad traverses reduce the number of rifles accommodated, and to meet this difficulty passages may be made around the front of the traverse and arranged for fire delivery. Such passages also furnish a flanking fire on the fronts of the adjoining sectors. A large number of machine guns will reduce the number of men necessary in the trenches.

2. *Kinds of Trenches*

The simplest form of trench (rifle pits) were much used in Belgium, where time did not permit more digging. At first it was hard to construct trenches narrow enough to escape being bullet catchers, but as the position was developed there was a demand for traffic room in the trenches and they had to be widened. In 1915 the trenches were deep and narrow, but now they are wider and shallower, thus affording room for trench mortars, etc.

Round timber, brush behind stakes and continuous hurdles are the favorite revetting materials. Wire netting is used only as a temporary expedient. Corrugated iron is used extensively for the roofing of splinter-proofs, and all trenches have wooden floors.

3. *Cover*

Cover protects and conserves the soldiers' physical and moral strength and must be constructed even in the hasty trenches of maneuver warfare whenever possible. Where material is available, splinter-proofs will be constructed, a common shelter being built for every four men. The following table gives the minimum dimensions for roof timbers:

For 1 m. clear space............Planking 8 cm. thick
For 1½ m. clear space..........Planking 10 cm. thick
For 2m. clear space,
Timbers 15 x 15 cm. or round timber of 20 cm.
For 3 m. clear space.............Timbers 20 x 20 cm.

With weaker woods intermediate supports are necessary.

4. *Further Development of the Position*

Trenches are constantly developed and improved in the same manner as the bomb-proofs. Neatness must be the general rule, especially with latrines. Buckets and casks, emptied at night, are efficient. A liberal use of chloride of lime or other disinfectant will prevent contagion. Good drinking water is scarce and in some positions only boiled or sterilized water is permitted. Some trenches are piped for water, others have electric lights, while all have telephone systems. Drainage is of great importance and concealment, especially from airplanes, must be carefully studied.

ENTRENCHMENTS—Continued

5. *Obstacles*

Wire entanglements are still the best obstacles. Abattis, military pits and chevaux-de frise are still used.

6. *Fortifying Villages*

When a village is prepared for defense every house must become a little fortress. Combustible articles are removed, and receptacles filled with water. Doors are fastened, and door catches and stone steps removed. A firing slit is sawed in the door at the required height and the necessary cover arranged for. Windows are so prepared that kneeling riflemen may fire over the sills and obliquely downwards. The cellar must be prepared so as to be shot-proof and cover sought therein during the artillery bombardment. If the house is shot to pieces the soldiers find cover behind the ruins. Board fences should be removed.

7. *Conclusions*

Shooting and intrenching are the soldiers' great accomplishments and they must be learned and practiced. The work of improving and strengthening the position must never cease, for no one knows just where the enemy may try to break thru, and it must be remembered that spadework offers a healthy counterbalance to the crouching in narrow holes so inseparably connected with the modern method of fighting.

[Military Engineering. What Germany Has Learned from Russia About Trenches and Cover. By Albert K. Dawson. *Scientific American,* May 26, '17. 500 words. Illustrated.]

In solving the problem of defense against modern artillery fire, the Germans have devised the underground trenches called "catacombs of war." The writer thinks they got the idea from the Russians in the early part of the war. The Russians were obliged to seek cover from the preponderant enemy artillery. Also the Russians utilized the experience of the Japanese war. The first underground quarters observed by the writer were in the Russian defenses of Ivangorod in 1915. The Germans praised these captured defenses, then adopted the idea and carried it further. At points behind the Russian lines were found underground barracks large enough to shelter from 200 to 400 men. Usually the barracks were built in pairs with a connecting tunnel.

[Organization in the Field in France and Gallipoli. By Captain H. M. Leapman, 13th Rajputs. *Jour. United Service Inst. of India,* Jan, '17. 2250 words.]

(Notes from experience with an Indian regiment in France and afterwards with a K-1 battalion in Gallipoli.) The organization of British and Indian units is very similar, so no differentiation is made in dealing with them. Troops relieved from trenches in France got complete rest from enemy fire unless in brigade reserve; those in Gallipoli were never out of range of the enemy guns, and generally not out of range of rifle fire. Ships were the only safe refuge at Gallipoli, as there was little depth to the ground gained. The base was overseas at Mudros. Communications depending entirely upon ships cannot be called secure.

From General Headquarters in France travel to the "railhead" is by London motor omnibus. From there the "refilling point" may be reached by 3-ton motor lorries; 106 of these, serving two divisions, were seen on the road at once. From the "refilling point" horse-drawn vehicles complete the journey to regimental quartermaster's quarters, from which the regiment is reached on foot.

Cooking for the regiment was done at the quartermaster's quarters. The regiment in divisional reserve, two miles behind the line, was under heavy shell fire. A blanket and waterproof sheet were all the kit an officer was permitted to carry into the trenches.

At Gallipoli spare kits were left in regimental "dumps" when units went to the trenches. On being relieved or changed to another post, organizations were first taken to the dump to secure their kits. Drinking water was very precious, so bathing had to be done in the sea and at night time, as the Turks fired shrapnel at bathing parties. Organization in the trenches in France and Gallipoli was nearly the same.

Reliefs were carried out by companies. Commanding officers inspected the trenches before bringing up their companies and taking over the listening posts, sentry posts, snipers' posts, ammunition, flares and bombs. After all information relative to the enemy, telephones, etc., had been imparted, the relieved company departed. Reliefs were generally carried out at night in France and in the day time in Gallipoli. Trench life was generally dull except for two or three hours of intermittent shell fire by the Germans, beginning about 8 a. m. daily. Cooking was done by individuals. All ranks carried two days' rations. It is better to construct dug-outs under the parapet than in the parados on account of the throw-forward from shrapnel. Supports are necessary for the roof and sides of the dug-out. A type of dug-out had 5 feet frontage by 8 feet in depth. Two feet of loose stones, brick or earth on corrugated iron or wood was proof against shrapnel. A layer of sand bags over broken pieces of brick on corrugated iron was considered the best shrapnel-proof top. Dug-outs were only used for temporary shelter from the sun in Gallipoli. Extensions and repairs to earthworks had to be carried out at night.

Where trenches were 12 to 15 yards apart, wire netting was fixed up to prevent the Turks from throwing bombs into the trenches. Where trenches were commanded crossing a valley, large sandbag transverses were built at short intervals. Sentinels were generally one man in every three by night and one in every six by day. In the trenches rifles were kept loaded at hand. They were inspected daily. Boots and equipment without the pack were worn always. Bayonets were kept fixed between dusk and dawn. Besides regimental bombers, each company in Gallipoli trained three non-commissioned officers and 18 men. In an attack, men with bayonets fixed preceded two bombers who carried as many bombs as possible in their hands. Next came the commanding officer, followed by two

bomb-carriers carrying bombs in sacks or haversacks to replenish bomb throwers. Both the Turks and Germans were good at bombing. Well-directed fire by snipers may dominate the enemy and make it possible to poke one's head or walk around the trenches at will.

Communication was delayed thru inability of orderlies to find commanding officers. This was remedied at Gallipoli by having two orderlies for each company, one with the company commander and one with the regimental commander.

Flash protectors are necessary for machine guns. Gun positions are marked down by the flash and destroyed by howitzer fire. It is very difficult to locate or estimate the number of machine guns opposed to you.

Great importance was attached to sanitation. Latrines were dug T-shaped, one side of the top being used at a time. Lime was supplied for use on fouled ground. As dead bodies were lying around, flies were a great curse at Gallipoli, and on hot days the state of the trench was almost unbearable.

Men carried 250 rounds of ammunition. In France picks and shovels, rubber boots, and flares were a part of trench stores. Officers carried Very pistols. Every man carried a waterproof sheet.

—Drainage of

See also
PUMPS—TRENCH

—Effect of on Morale

[Impressions from the European War. By Major P. Charpin. *Mem. Del Ejército* (Chile), Feb, '17. 975 words.]

It is not a new principle for a somewhat untrained army to adopt the defensive expedient of trench warfare, where field fortifications and accurate use of long-range weapons make up for any inferiority in training.

In the present war we see large armies, animated with an intense offensive spirit, buried in deep trenches. At the beginning it was believed that this condition would be temporary, but it has continued for over two years.

Doubtless, the offensive impulse of these armies often receives a setback by heavy losses, out of proportion to the objective to be gained. In this connection, another very important fact enters into the problem, and this is the loss of the maneuvering mobility of even the best troops after a long time in the trenches. The atmosphere of trench life is very different from that in which the young reservist had been trained. The body, the soul, the moral character, and the physical capacity of the soldier undergo a very marked change. Regiments which heretofore have covered themselves with glory have been beaten as a result of this trench life. Those in command have become convinced that men who have been held for a long time under such conditions need to be retrained, given new life, and disciplined again in order to regain that cohesion necessary to resist the avalanche of projectiles with which the enemy sweeps all avenues of approach.

Offensive operations are undertaken with troops which have been especially trained over ground covered with obstacles, similar to or more powerful than those which they are likely to encounter in actual operations; with troops which have been trained in the rushes, in the assault, and in the throwing of bombs. This training is repeated day and night until perfect cohesion and discipline exist. As a result of this trench warfare, we have two different armies: one occupying the trenches, always on the alert, and another one in the rear being trained to make the assault and conquer new trenches.

—Equipment

[Wilson Mono-rail. By Lt.-Col. Arthur A. Crookshank, R.E. *Royal Engineers Journal*, Sept, '17. 800 words. 2 plates.]

This mono-rail was designed by Major Wilson, R.E. Wooden beams are placed across a communication trench overhead about 6 feet apart. A strap of square iron goes round the beam and has suspended from it a hook with a split end. The rail, of flat iron about 2¾ by ¼ in., rests in the split ends. The car, which is designed light, consists of a wooden tray just large enough to carry a stretcher; it will take a load of 200 pounds as an alternative. The tray is suspended by a continuous wire from two pairs of small grooved wheels. The mono-rail can be run overground outside the trench area by bracketing out from posts. The system has many advantages over the Decauville or other types of trench railways.

—Semi-Permanent

[Newest Wrinkles in Trench-Building. Quotations from an Article by Dr. P. Chavigny in *La Revue Générale des Sciences*. *Literary Digest*, July 21, '17. 1800 words. Illustrations.]

(A popular article concerning the revetment of trenches and their protection against damage by surface drainage or ground water. The usual forms of revetment are described, and the fact is noted that the useful life of many of them is brief. The most permanent is a plank revetment supported in bad soil by trench frames, *i. e.*, using a frame with strut at top and bottom in lieu of the usual toe-hold and back-anchorage.

Preservation of the slopes against the action of rain and drainage is difficult. The best solution is to plant the slopes with vegetation of local growth which has matted roots and foliage. The usual trench-berm is useful as preserving a band of the regular vegetation growth, in addition to its function of relieving the revetted slope of a superincumbent load.)

—Tactics

See also
TACTICS—OFFENSIVE AND DEFENSIVE

[Trench Warfare. By Captain Fernando Freiria. *Revista Militar* (Portugal), Dec, '16. 3000 words.]

On the extensive lines of battle in the great European conflict, mobile warfare has given place to a war of position. Napoleonic principles of war have been superseded by those of the epoch of Louis Fourteenth, of Vauban, and of Louvois. Vast tactical maneuvers

ENTRENCHMENTS—Continued

of the past have been simplified into straight frontal attacks, which, altho they exact a heavy toll of life, offer the advantages of the utilization of field fortifications. This in turn brings the conflict to a war of sappers and miners.

The long stay which the belligerents have been compelled to make in the same territory has led to the establishment of almost interminable lines whose flanks cannot be turned, and this, in connection with the various means employed to prepare for both attack and defense, has led to the present warfare. Large bodies of troops being present in the same locality has led to the complicated systems of trenches constructed to give protection from artillery fire to the occupants, in comparative comfort, at the same time affording ample opportunity for troops to make counter attacks. Gains made in this sort of warfare are almost yard by yard. Infantry cannot attack except after careful aerial reconnaissance and preparation by artillery. The artillery preparation is intended not only to clear away obstacles, but to have such a tremendous effect upon the enemy as to destroy his morale and render him incapable of making a stubborn or determined resistance.

A system of trenches to be effective must possess the following qualities:

a. Possess the strength to resist heavy and continuous bombardment.

b. Have a clear field of fire for infantry and machine guns over the ground on which the enemy must advance.

c. Be well protected in the front with the object of halting an attack, or delaying it as much as possible, under the direct fire of the defenders.

d. Protect the defenders from the elements as well as shell fire.

e. Be composed of many different lines and be ample to hold all troops necessary for the launching of an attack.

f. Ample room for passage, good communicating trenches to permit the rapid reoccupation of different parts of the trench, temporarily evacuated, to send in reinforcements rapidly, to permit the delivery of provisions and supplies, for rapid evacuation and for local counter attacks.

g. To permit the localization of the effects of penetration by an adversary of any part of the system without imperiling the adjoining portions of the trench.

Any system of trenches must satisfy the majority of the conditions set forth, and it must consist of not less than three lines, the advanced or combat lines and those of the reserve and the supports.

The usual tactical considerations govern the selection of the location of trenches.

[Trenches and Billets in France. By Capt. H. Wilberforce-Bell, F. R. G. S. *Jour. United Service Inst. of India*, Jan, '17. 3100 words.]

Our former conception of war included the rapid concentration of troops in points of vantage, battles of a few days duration, complete investment of fortresses and the use of hasty intrenchments. Now, airplane reconnaissance prevents surprise thru rapid concentration of troops, and battles continue for weeks and even months. Maubeuge is the only fortress that has been completely invested. Elaborate entrenchments have supplanted modern fortresses. The former are not so readily destroyed by modern artillery. The long duration of battles makes necessary the continued relief of troops and gives rise to the opinion that man power will be the deciding factor in this war.

For the most part, two classes of trenches were employed before the war; shelter trenches hastily constructed by advancing infantry, and trenches prepared in defensive positions. The latter were generally from 5 to 6 feet deep, with a berm and step and probably affording head cover. They usually occupied a position on rising ground and were entered thru a zigzag trench a quarter of a mile or more in length. The present trenches are very different. They are deep and without any berm, the step is a bench, and the cover afforded is anything up to 20 feet of earth.

"Duck boards" are put on the floor to keep the trenches passable in wet weather. Bombs and ammunition are stored in boxes kept in recesses in the traverses. The "dug-outs" are built in recesses in the parados. Some of these are elaborately constructed to great depth. They are roofed with beams or sheets of iron and provided with windows of gauze or muslin. The largest dugouts are used for messes or for officers' quarters. They are not proof against high explosives or mines.

Machine guns are located in emplacements built as strong as possible. To lessen the risk of detection, they are employed for night firing only and then in an oblique direction. They are not fired by day unless their use is imperative to repel an attack. An emplacement located by the flash of a gun becomes a target for hostile artillery.

Early in the war the Germans employed the machine guns as follows: During the night they would construct a V-shaped trench (plan) between the lines. Advancing infantry occupying this trench would be completely annihilated by machine guns placed at the ends of the two arms. In action, machine guns are demoralizing as well as deadly. Located in keeps or emplacements which cover straight portions of communication trenches, they stop any advance. Also, they are used against airplanes and for indirect fire from positions well behind the line. English guns fire more rapidly than German guns, and the English probably have more of them than the Germans.

Many forms of loopholes are used. A common form is a long box let into the parapet. The most popular is the steel loophole with small shutter. Daylight must not be seen thru a loophole, so a flap closes the enemy end, and a curtain hangs down over the shoulders of the sniper when the flap is open for use. Germans use mixed colors to render their loopholes difficult of detection. Black and red sandbags mingled with others of a dirty drab color will accomplish this. A loophole

that can be seen should be considered a dummy. Once "spotted" a loophole should be abandoned. Sniping and occasional shooting is done thru loopholes. During attacks infantry fires over the parapet.

The wire entanglement must be watched and patrolled constantly to prevent the enemy from cutting it. Patrols are both assisted and hampered by flares and Very pistol lights. Listening posts are maintained 60 to 100 yds. in advance of the firing trench to which they are connected by a covered communication. The garrison of four or five men, one a bomber, is protected from rushes by a wire entanglement.

When a portion of a trench is captured, bombing proceeds in each direction. The defenders may block the trench in two places, not far apart, forming a "Glory Hole" between the two blocks. Any attempt to advance by breaking down either block is met by a shower of bombs from the opposing side.

Latrines are constructed behind the firing line and connected to it by a narrow trench. They are kept in good order and changed frequently. Empty tins are burned out and particles of food burned to avoid plagues of flies.

Front line trenches are not shell proof. They remain because the enemy cannot afford to be always obliterating them. Trench mortars are movable and do not stay long in one place. When located their position is immediately treated to a storm of artillery shells which damages the parapet. Shells from trench mortars can generally be seen when in mid air and avoided if warning cries and signals be given. Gun fire casualties are not numerous on an average day. The "Morning and Evening Hates" are sufficiently regular to warrant taking cover during certain hours.

Communication trenches form a great mass of zigzags on the western front. The best of them are from 7 to 8 feet deep and so narrow that great care must be taken, when reliefs are in progress, to prevent two parties going in opposite directions from meeting. Deep trenches continue back to the point where rifle and machine gun fire becomes ineffective.

The bombardment or "funk" trench is parallel to the firing line and close to it. It is usually about 9 feet deep and often so narrow that a man must walk sidewise to squeeze thru. Sentries hold the front line during bombardment while the remainder retire to the "funk" which affords cover from shrapnel fire. The trench is quickly manned at the conclusion of the artillery preparation, but trenches have been rushed before the firing line can be formed by synchronizing watches and advancing just at the moment bombardment ceased. The support and reserve trenches are constructed similar to the front line trenches some distance behind the firing line, but easily accessible. Provided with wire entanglements, and machine gun emplacements at every favorable point, they are intended for defense in case the fire trenches are lost. Battalion headquarters are usually in the reserve trenches.

Owing to the advent of the airplane and balloon, hedges and canvas screens afford no cover from view. Whenever they are met with the passer-by is careful to get beyond the screen and into the trench on the other side as quickly as possible. Screening of artillery and machine gun positions from above is successfully accomplished largely because the observer must from necessity be thousands of feet in the air. The excellent quality of present-day field glasses and telescopes makes concealment from an observer on the ground well nigh impossible. Observers in "Sausage" balloons which are anchored at intervals behind the lines are especially vigilant when airplanes are not about. Equipped with powerful glasses, they observe every movement of bodies of men or artillery, and these immediately become targets for heavy artillery or high explosive. The excellence of roads and railroads in France and the plentiful supply of motor ambulances are largely responsible for efficient medical arrangements. From first aid stations near the line, thru dressing stations and clearing stations further back and extending to the base hospitals, the highest state of efficiency prevails. Beyond the point where it is not deemed advisable for horses or motor transport to approach, the allies employ trolleys to assist in the distribution of supplies. It is believed the Germans have small railways close up to the firing line, as trains can sometimes be heard at night when the air is still and musketry fitful.

Reliefs from trench duties are carried out as quickly as possible to avoid crowding the communication trenches. As soon as the relieving unit is in place a start is made without talking or shouting. An officer precedes the relieving party to learn his way about and take over trench stores.

"Billets are of two classes, good and bad." The government pays well for them and ordinarily the farmers and others do all they can for both officers and men. Much work is accomplished by troops in billets; clothing and equipment must be cleaned and repaired, hot baths taken, feet inspected and drills and bombing practice seriously undertaken. The most disagreeable work is digging trenches behind the line at night. This means a march out, several hours digging, and a march back.

The army is in splendid physical condition, its equipment and morale are excellent, and it is looking forward to the time when an advance will terminate the monotony of trench life.

—Use of in European War

See also

FORTIFICATIONS—FIELD—USE OF IN EUROPEAN WAR

[The Germans' Defensive Line On the Somme. By E. F. *Sphere*, Mar 31, '17. 1000 words. Diagrams.]

The piercing of the German line between Arras and Peronne has given more definite knowledge of the German defensive system. (The diagrams show plan and sections of an individual example.) In the example illustrated, a firing trench facing west abuts on the tow-path of the Somme Canal. In a 40-yard section, two galleries 6′ x 4′ lead down from the trench to a chamber about 40′ x 12′, with about 15′ overhead cover. The chamber has two air shafts and two galleries leading to the rear and opening on the tow-path. There are thus six exits in all from the chamber. The cham-

ENTRENCHMENTS—Continued

ber and galleries are lined with wood baulks and planks and floored. They are just under 7' in height. One of the galleries had double-tier bunks on one side thruout its length. A gallery near the exit leads to a separate room for the commandant with its own air shaft.

Another set of diagrams shows a front-line shelter. The trench is about 8 feet deep and 12 yards long, designed for a half section of riflemen. Two stairways and two ladders lead downward and forward to a main shelter under the parapet. The overhead cover is about 10 feet. At one end was a small lookout chamber with periscope.

Different forms of construction were used, sometimes one or more layers of logs or joists, sometimes iron beams, and sometimes masonry or concrete.

The danger to these shelters lies in the incomplete protection of the exits. The chief safeguard is a multiplicity of openings.

One difficulty in attacking a position so fortified lies in the impossibility of locating all the trenches and shelters, so some of them escape destruction in the bombardment. The attack is frequently held up by these undamaged sectors, which have to be isolated and reduced one by one.

[Small Forts and Heavy Artillery. By Captain T. *L'Illustration,* Jan 13, '17. 1600 words. Plans and sections.]

In each great offensive the official accounts tell us that the advance has been frequently annoyed, and sometimes stopped, by small forts and redoubts. One must then wait until the artillery shall have made a fresh preparation. In this war, so filled with surprises, it is certain that the ancient conception of the small fort or redoubt has to be changed. It is to-day a closed, isolated work, resulting from the extension of suitable partitions established for the purpose by the defender in a position, part of which has been lost by him. This work is in general composed of trench elements barricaded toward the side captured, (and this is what is meant by partitioning) containing one or more shelters, proof against large shells, and defended by a well-supplied garrison determined to continue the struggle until death. The essential element of the small fort is the *proof* shelter. These shelters against formidable bombardment, are constructed in the various lines of the successive positions of each sector, and are certainly needed to resist the effects of heavy shell. A large shell buries itself deeply in the soil and produces, at the moment of its explosion, a crater. The effect of such a shell resembles in every respect that of the explosion of a mine charge. These shells, provided with a very slow-acting fuse, are destined to destroy buried shelters. Against shelters of concrete or employing metallic beams side by side, base fuse shells must be used. The blast of the explosion is deadly; besides producing in some cases insanity and deafness, it has been known to wound and even to kill men. To destroy the effects of the blast, entrances are so to say staggered. The Germans bury as deep as possible the shelter proper so called, i. e., the living quarters, below the line of limiting rupture. In certain cases they employ a protection built of resisting materials, and called the bursting layer. This is composed of several layers of stout logs separated by other layers of sand-bags; sometimes metallic double "T" beams are used, or masonry or concrete. In any case the bursting layer stops the shell, which thus explodes on the surface and its interior effects are practically negligible. The Germans have shown much care in the construction of their shelters and have concealed them by avoiding spoil banks and by letting the trench near the entrance keep its general form. In spite of all this, these entrances are extremely vulnerable to the heavy artillery and even, in the general case, to the percussion shell of the field gun. To remedy this defect, the number of exits has been increased, and ventilation and rescue-shafts have been added through which men may crawl. All entrances are more or less distant from one another so as not to be destroyed by one and the same shell. Entrance to all types of shelter is by stairways properly sheathed. One of the most curious shelters constructed by the Germans was along the Somme Canal, west of Frise. In the embankment had been constructed two entrances revetted with stout logs strongly propped. This shelter was carefully built, completely sheathed and floored. The rooms were furnished and floored. In one of the galleries were installed superimposed bunks.

A totally different kind of shelter is that made of curved sheet-iron plates. This shelter is deeply buried and holds a half section. The Germans established in certain trenches series of eight or ten of these. This type is 8 meters long, 2.8 meters wide and 2 meters high in the center, and all were floored. Two entrances, curved so as to separate their extremities as much as possible terminated in a trench at the splinter proof. In this way one and the same shell could not destroy both.

Finally we have the ordinary shelter like a mine gallery, with two or more steep descents. This is the general type. The Germans are sinking it deeper and deeper and have gone down as far as eight meters. It is easy to imagine the difficulty of destroying shelters thus buried. They are almost always so well dissimulated as to escape detection. Consequently, one is driven to the expedient of using zone fire over the entire region where these shelters have been determined to exist. But yet in spite of the incredible expense of ammunition exacted by zone fire, numerous shelters are found intact because their existence had not even been suspected. It is the garrisons of these shelters that suddenly emerge in the ocean of iron and fire which we call artillery preparation. They penetrate rapidly to the neighboring trenches, thus constituting in a few moments those centers of resistance against which our infantry hurls itself. If these

small forts therefore do not fall in the fury of the first assault, they have to be surrounded and thus delay the advance of the offense.

EQUIPMENT, Military

See

CAVALRY—ARMS
INFANTRY—ARMS
TELEPHONY—APPARATUS AND EQUIPMENT—FIELD EQUIPMENT
UNIFORMS

EQUITATION

See also

CAVALRY—INSTRUCTION AND TRAINING—SCHOOLS

[Position of the Military Rider. By Major Francisco Fermoso. *Memorial de Caballeria,* Sept, '16. 3000 words.]

Many officers ridiculously exaggerate the modifications in the military seat introduced by the new Regulations of Equitation. These prescribe that the body should be kept *vertical* when at a halt or marching at a walk, and *slightly inclined forward* when trotting, galloping, or jumping. The shoulders should never be carried forward of a vertical line opposite the knees of the rider. The limits which fix the position of the rider in all circumstances being so clearly defined, when officers are noticed with the body inclined grotesquely forward, even when riding at a walk, one should remember that neither the system nor our regulations should be blamed, but the bad taste or ignorance of the individual. The regulation military seat is easy, graceful, and elegant only when the prescriptions are complied with exactly. In this seat, balance and friction are sought. Many riders think that when they do not sit down in the saddle but arch their bodies far forward with the chest concave and face down they are imitating the Italian method. In reality they are but making people laugh at their position, so antiquated, inartistic, and in violation of all ideas of common sense.

(Remarks on the principles of correct riding follow.)

[School of Military Equitation. By S. B. *Memorial de Caballeria,* Nov, '16. 3000 words.]

(Continuation of a previous article. The mission and scope of the school are outlined. The work of the "Military Class" in field service is treated of in this issue.)

(To be continued.)

[School of Military Equitation. By S. B. *Memorial de Caballeria,* Dec, '16. 1300 words. 4 illustrations.]
(Conclusion.)

(The general program of the school is given and the course commented upon in detail. The article does not permit of condensation.)

[Letter About Questions of Equitation. By B. S. M. *Memorial de Caballeria,* Jan, '17. 1800 words.]

An immense advance is noticed in instruction in equitation in various of the cavalry regiments. It is the purpose of this letter frankly to enumerate a few of the defects which, notwithstanding the excellence of the training, still remain in evidence.

The use of very short stirrups is frequent. Sometimes the stirrups are so short that the weight of the rider is placed far back and the thighs are almost horizontal. Balance, friction and control, all prerequisites for good riding, are thus lost. The Regulations (page 60) show clearly how the stirrups should be adjusted. In some cases whole platoons are observed in which the men are riding with very short reins, the arms being completely extended and the hands nearer the poll than the withers. This fault is serious. The body should be vertical at the walk and slightly inclined forward at the trot and ordinary gallop. Only when the extended gallop is taken, and when jumping, should the inclination forward be more pronounced—never to the extent of raising the seat and lowering the head as in the ridiculous curved position so often seen. Another fault is immobility of the hands when jumping. This should be guarded against by requiring the recruits from the very first to exaggerate the forward movement of the hands so that the horse is given free play of the head and neck.

While training their platoons officers should praise individual merit and censure individual faults, the reason why being indicated clearly in every case.

[A Study Upon the Rein of Opposition. By Major Fermosa. *Memorial de Caballeria,* May, '17. 4000 words.]

(Conclusion of an article on equitation. The rules and commands for instruction in the various uses of the reins and other aids are given and explained.)

—Riding Halls

[The New Type of Riding Hall. By —— —— (author not given). *Riv. Mil. Italiana,* Oct-Nov-Dec, '16. 700 words. Tables and illustrations.]

(This is a design for a riding hall 200 feet long, 80 feet wide and 48 feet high, built of stone or brick masonry, with an arched roof of corrugated iron supported by steel beams. A gallery is provided on one side. A detailed estimate is given, showing the total cost to be $39,000.)

EROSION

[Erosion of Fire Arms. By Lt.-Col. Medina. *Memorial del Ejército de Chile,* Mar, '17. 4500 words. (Illustrated.)]

Fire arms may be injured by bad treatment, blows, lack of care and by being put to excessive use. It is not the purpose of this article to discuss defects caused by lack of care and bad handling, but to put in concrete form modern ideas about erosion which have been gathered from scientific works of other countries.

The principal cause of erosion is the action of the propelling charge when it changes from a solid into a gas at the moment of discharge. The force of the explosion of the powder produces two effects; the one of rupture or deformation, which injures the piece, the other of propulsion which constitutes the useful force that throws the projectile from the barrel. In

addition to the mechanical effects of this deformation or rupture, the chemical composition of the gases and the temperature work upon the barrel both chemically and mechanically. Study and scientific and experimental investigation are brought to bear upon this subject in order to prolong the life of firearms. Experiences in the United States have shown that a modern 15 cm. gun is useless for war purposes after 166 rounds, guns of 20 cm. after 125 rounds. Guns larger than the 20 cm. caliber are thrown out of service after 125 rounds. Those of 25 cm. are useless after 100, and those of 30.5 cm. are unserviceable after 83.

English guns of 30.5 cm. have been reported as unserviceable after 60 rounds.

At the moment of firing a current of gas is developed at a temperature higher than 2000°C. This gas flows at great pressure and speed thru the barrel, heating it rapidly and causing it to vibrate. Immediately after firing opposite conditions occur. The barrel cools rapidly, the heat being absorbed by its mass under the pressure developed. With the repetition of firing, dilations and contractions are thus produced, the effects of which are prejudicial to the conservation of the arm.

Tests of the *initial velocity* and of the *precision* made by the writer with two rifles completely confirm the theory with reference to the influence of high temperature upon erosion of small arms. Actually the initial velocities of war ammunition are about the same (between 865 and 850 meters) up to 4000 rounds. After five thousand, the velocity decreases rapidly, being only 694 meters; after 10,000 rounds, it is 173 meters less than the normal velocity.

The curve of dispersions about parallels that of velocities. Diminution in precision is negligible up to 4000 rounds, but beyond 4000 the precision decreases rapidly and ogival impacts are produced. This demonstrates an irregularity in the movement of the bullet. The gun has therefore lost its ballistic qualities and in consequence is unserviceable for war. As the number of firings increases the impacts become more and more ogival until at from 6000 to 10,000 shots all of the impacts are cylindrico-ogival in form. This fact shows clearly that the bullets have lost rotation and strike sidewise.

Summary

Measures that should be applied to prolong the life of fire arms in the Army (Chile) are:

(a) Organization of an armament service with a technical personnel.

(b) Installation in each division of a small laboratory for testing purposes.

(c) Regulation of consumption of ammunition.

(d) Use of normal ammunition. This implies that ammunition made at home should be subjected to the same tests that are given to ammunition purchased abroad.

(e) The use of different powders for the different calibers.

(f) A technical inspection of all the arms in use. The collection of them into homogeneous groups and the withdrawal from service of defective arms.

—Of Artillery

See

ARTILLERY—EROSION AND LIFE OF

ESPIONAGE

[Espionage. *La Guerra y su Preparación*, Nov, '16. 5000 words.]

(This is an extract from the book, *Das Deutsche Heer*, by Major Schreibershofen. It describes methods of obtaining military information employed by the various governments in peace and in war, describes spy and counter-spy methods, and quotes historical examples illustrating results to be obtained from thoro systems of espionage, and also those from faulty ones.)

—In European War

[New Spy Trick of the Germans. *Canadian Military Gazette*, Aug 28, '17. 200 words.]

The Germans in France use a device projected into the Allied lines, establishing electrical connection with telegraph or telephone wires, thus enabling the Germans to tap passing messages regarding operations. Prisoners confirm stories that the German command obtained exact information of the hour set for attacks.

The new device is probably the most successful espionage scheme used by the Germans. The Allies have been mystified by the fact that organizations coming into the trenches have been greeted by placards or hailed by name. The new device may be the method by which such information was obtained.

ESPRIT

See

MORALE

EUROPEAN WAR

See also

CANADA—EXPEDITIONARY FORCE FOR EUROPEAN WAR

NIVELLE, GENERAL

[War Notes. By Captain H. M. Johnstone, R.E. (retired). *United Service Magazine*, Oct, '16. 3600 words.]

(Comments on different phases of the war.)

[European War, Echoes of: The Colonies. By Jose Paulo Fernandes, Capt. of Artillery. *Revista da Artilharia*, Sept-Oct, '16. 2400 words. To be continued.]

(A brief review of the part played by the colonies of the several belligerent powers in the present European War.)

[Declarations of War. By Countries Engaged. *N. Y. Times*, Dec 17, '16.]

Austria-Hungary declared war on Serbia, July 28, 1914; Germany declared war on Russia, Aug 1, 1914; Germany declared war on Belgium, Aug 4; Germany declared war on France, Aug 3, 1914; Great Britain declared war on Germany, Aug 4, 1914; Austria-

Hungary declared war on Russia, Aug 6; France declared war on Austria-Hungary, Aug 10; Montenegro declared war on Austria-Hungary, Aug 8; Great Britain declared war on Austria-Hungary, Aug 12; Japan declared war on Germany, Aug 23; Turkey began war with Russia by bombarding Odessa from the sea, Oct 29; Great Britain and France declared war on Turkey, Nov 5; Italy declared war on Austria, May 23, 1915; Italy declared war on Turkey, Aug 20; Russian ultimatum to Bulgaria, Oct 4; Russian ultimatum rejected by Bulgaria, Oct 6; Bulgaria declared war on Serbia, Oct 14. German troops violated French territory without declaration of war, Aug 2, and each nation's representative demanded his passports, Aug 3; France held that war began automatically with the attack upon her frontier. The German Minister left Serbia, Aug 9, 1914. The Turkish Ambassador left Petrograd, Nov 1, 1914. The five Allies joined in formal declaration of war against Turkey, Nov 10, 1914. In 1916 Germany declared war on Portugal, Mar 8; Italy declared war on Germany, Aug 27; Rumania declared war on Austria, Aug 28; Germany on Rumania the same day; Turkey declared war on Rumania, Aug 30, and Bulgaria on Rumania, Sept 1.

[What France Has Done for the Allies. *Rev. Mil. Suisse*, Dec, '16. 3600 words.]

The sudden German attack through neutral Belgium cost France the greater part of her resources in coal, iron-ore, cast-iron, and steel, and took from her the equipment and skilled labor of the great industrial centers of the north and northeast.

Here is a close estimate of what France lost:

49% of her coal resources.

90% of her iron ore.

80% of her coke, cast-iron, steel, and equipment.

Out of 112,000 workmen in metals, France lost 60,000.

In spite of the enormous difficulties attendant upon establishing new ammunition factories for her own purposes, France was already making ammunition for Russia in the early part of 1915. The aid given to her allies increased greatly as time went on.

[Report That Central Powers, Russia and Japan May Combine. *N. Y. Times*, Feb 21, quoted.]

The *Boston Herald* has received a dispatch from its Washington correspondent, in part, as follows:

"Forthcoming sensational moves on the part of Russia and Japan, it is authoritatively stated, are seriously complicating the international problems now before President Wilson. Germany's every effort at present it is said, is bent toward effecting a separate peace with Russia. This explains the delay on the part of German naval commanders in forcing a rupture with the United States according to reliable information.

"Japan, it is known, has already negotiated an agreement with Russia. The next development, it is stated, will be a triple alliance of the Teutonic Powers, Russia and Japan for the partition and control of the Far East.

"Germany, under the terms of this agreement, will exercise suzerainty over the Balkans and Near East. Russia will be permitted to dominate India, Japan will be given free sway in China. The phase of the coup said to be giving greatest concern to official Washington is the possibility of a warlike move on the part of Japan against the Philippines, if not against continental America.

"With the release of the Austro-German forces now holding the eastern frontier against Russia, it is pointed out, the Central Powers would be free to launch a gigantic offensive against France and England. The Japanese threat would prove a sufficient distraction for the United States to preclude any immediate action against Germany or any co-operation with England and France.

"It is understood that great pressure is being brought to bear on the President to take additional decisive steps against Germany at once, in order to prevent Russia's defection from the allied lines and the subsequent alarming international developments mentioned.

"It is known that the United States military forces in the Philippines are so disposed that they can be mobilized at Corregidor, in Manila Bay, on an hour's notice, and that the island fortress is completely provisioned for a year's siege. No attempt, it is said, would be made in the event of war with Japan to hold any point in the islands except this fortification at Manila."

[The War On Land. *Army & Navy Gazette*, Mar 10, '17. 1800 words.]

According to fairly trustworthy reports, the Germans have accumulated a maneuver reserve of 700,000 men. One authority says that the trained forces of Germany at date are by this amount larger than they were when the attack on Verdun began last year. However, the supports and local reserves are more numerous than a year ago, cutting down somewhat the maneuver reserve.

As the good campaigning season begins earlier in France than in Russia, it is more likely that the Germans will attack the English or the French than the Russians, for a delay would mean the loss of the initiative.

[America's Mission to the "War Conference." *Official Bulletin*, Nov 8, '17. 600 words.]

The American mission headed by Mr. E. M. House, of which the Chief of Staff of the Army and the Chief of Naval Operations are members, will attend the Allied War Conference. The object of the Conference will be to perfect a more complete co-ordination of the activities of the various nations engaged and a more comprehensive understanding of their respective needs in order that the joint efforts of the co-belligerents may attain the highest war efficiency. The United States desires to use its man power and material resources to the greatest advantage against Germany.

EUROPEAN WAR—Continued

Italy

Italy has no coal. It used to be supplied almost exclusively from England. The rise in freight rates made this burdensome for Italy, and France has permitted her to economize by sending her coal from mines in the central part of France. France also furnishes Italy certain special steels.

The Italian field gun is the work of a French artilleryman, Colonel Deport. France has sent quantities of shell and considerable heavy artillery. She has furnished more than 100 trench mortars, 600,000 grenades, 500,000 helmets and 40,000 breast plates, hundreds of tons of aluminum and chemical products.

It is again France that furnishes a great part of her aviation matériel, and it is a French aerial squadron that defends Venice against the Austrian aviators.

Italy reciprocates by exempting from service the Italians employed in French munition factories and by sending automobiles, food products and some textiles.

Rumania

France supplies Rumania with all her matériel and munitions. She furnished more than 100,000 rifles (and sends now 10,000 per month), 80,000,000 cartridges, more than 1000 machine-guns and ammunition, more than a million hand grenades. She also makes ammunition to fit Rumanian rifles.

The supply of field guns and matériel has been considerable. All the aviation equipment is made by the French. First, the latter gave them 200 airplanes and now supplies matériel for their construction in Rumania. The French effort has not been less considerable in the matter of automobiles.

French industry has already made for Rumania 200,000 helmets, 500,000 masks, bath installations, apparatus for sterilizing water, etc.

The matériel sent to Rumania goes by Archangel.

Rumania, surprised by war methods for which she was insufficiently prepared, has asked for technical assistance. Many officers have been sent from France.

* * * * * *

From the beginning of hostilities until Nov 1, 1916, France had turned over to her allies:

30% of her total production of rifles, 1907-15.

22% of her total production of rifle and machine gun cartridges.

20% of her total production of field gun shells.

13% of her total production of trench mortars.

27½% of her total production of hand grenades.

5% of her total production of explosives.

Russia

France has furnished Russia material which the latter lacked and lent her technical experts and specialists to intensify Russia's home production.

On Oct 1, 1916, France had sent, or was about to send, to Russia, more than 600,000 rifles and 300,000,000 cartridges, several million hand-grenades, several million rounds of fixed ammunition for field guns, several hundred guns, etc.

France has sent thousands of aeroplane motors to Russia, as well as other necessary parts. Besides 1600 motor trucks and ambulances and 140 touring cars, she has sent quantities of secondary articles, cartridge cases, rockets, search-lights, etc. The monthly exportation in material was more than 16,000,000 kg.

Before the completion of the Mourmane railroad, everything went by way of Archangel, a port closed by ice six months in the year. The British fleet cooperated.

Much attention was paid to the development of Russian national production. Models of field pieces, small arms, trench mortars, airplanes, were sent, as well as skilled workmen.

The Pyot mission assumed the task of converting factories into ammunition plants.

Twenty-two French officers, experts and specialists, have important positions in Russian war factories; 236 non-commissioned officers and soldiers occupy in them almost all the positions as engineers or foremen. Finally, France has sent to Russia a radio-telegraphic mission, another mission to instruct in machine-guns and a mission to study transport conditions in Russian territory.

Serbia

From the end of 1914 until the evacuation of Serbian territory, France furnished Serbia with 2000 rounds of 75 ammunition daily.

Since then the Serbian army has been made over and transported by France. When the Serbs retreated to the shores of Albania, they arrived there exhausted. The French transported 150,000 men and 10,000 horses to Corfu and Bizerte (Tunis). About one-fourth of the men had to recuperate in hospitals, and it was a colossal task to provide accommodations for them.

A French mission lost no time in conferring with the Serbian authorities on the matter of reorganizing the units and resuming their training. The Serbs began to disembark at Corfu on Jan 8, 1916. By the 1st of June they had been transported to Chalcidique, were fully equipped and could have entered upon a campaign at once. On Sept 12 the combined French and Serbs defeated the Bulgars and entered Serbia again.

The transport operations had been most carefully regulated at the French Ministry of War. Three centers, Orange, Lunel and Montauban, collected the war material and sent it to three ports, Cette, Marseilles and Toulon. Matériel and animals were systematically numbered, so that each unit landing at Salonika drew all its equipment and matériel without a hitch.

The transportation of the Serbian army from Corfu began on Apr 12. It was conducted with the cooperation of the French navy; 76 trips were necessary. Not a single life was lost.

At present, the supply of arms and munitions, horses, wagons, airplanes, is attended to by France. The supply in clothing and rations and the hospital service are accomplished by co-operation with England.

France has furnished Serbia 100,000 rifles, several hundred machine-guns, several hundred field, mountain and siege guns and ammunition for same, 4289 military wagons, field hospitals with 7000 beds, all the telegraph and telephone matériel necessary for an army in the field. The aeronautic service is performed by French air squadrons.

—General Notes on Operations, By Theaters

GENERAL

[Diary of the War. By A. F. B. *Revista de Artilharia,* Nov, '16. 7500 words. To be continued.]

A continuation of the daily journal of the war on all fronts for the month of January, 1915.

[Impressions of the Austro-Hungarian Front. By V. *Revue Mil. Suisse,* Aug and Sept, '16. 7000 words.]

The Austro-Hungarian army with its 12 nationalities, its different languages and customs, is an especially interesting study for the Swiss.

Indeed, this army, apparently so devoid of homogenity, astonishes all those who have been closely associated with it during the war by its moral unity and its solidity. The disintegration of Austria-Hungary at the first threat of external danger had been so often predicted that the performance of its army is a constant source of surprise for her enemies.

The present war is not a race war; Austria proves it. Serbo-Croat regiments, Dalmatians, Istrians and inhabitants of the Trentino of the Dual Monarchy are fighting against their Serbian, Slav and Italian brothers. This fact is not indifferent to us. If we pitch in, no matter on which side, many Swiss will inevitably face adversaries of the same race as they are.

There is among the contingents of the 12 nationalities a spirit of kindly tolerance and mutual comprehension which facilitates a great deal relations that are made complicated by the extreme difference of language and temperament. The striking thing is the promptness with which these men succeed in understanding one another. All the soldiers know a few words of German, which is the official language of the army, except for the Hungarian landwehr. For the rest, they get along with a few barrack room expressions borrowed from a dozen languages.

The salient character of this army is *flexibility,* physical and intellectual flexibility. The individual man gives an impression of great mobility and so with all the subdivisions. In the field, the infantry advances rapidly, making light of obstacles; the seat of the troopers is at once elegant, solid and bold. Discipline has not atrophied the will, it makes supple without breaking, it leaves each individual and each nationality its own character, its mentality, its customs, in order to obtain, in return, a sum of effort and devotion, the greater because it is mingled with gratitude. The special qualities of each race co-operate toward the common end. A healthy emulation urges the corps to outdo one another on the battlefield; provincial individuality is a lever which must be used intelligently; in Switzerland it would accomplish marvels on occasion, for each canton has its history and traditions.

In the ranks this flexibility is manifest by drill movement as exact as the German, but which recall rather those of a class of trained gymnasts. Immobility at carry arms is absolute, without giving an impression of stiffness. The German parade-step has no equivalent in the Austrian army, it is not executed at all. (The editor has a distinct recollection of having seen Hungarian troops doing the goose-step at guard-mountings in the palace-yard in Vienna in 1907.)

Living several months the life of this army, he who writes these lines has been able to observe this mental flexibility, the absence of prejudice, the breadth of view of the Austro-Hungarian officer. With him any discussion is possible, and all his relations are marked by the greatest courtesy. He has an astonishing adaptability which comes from the variety of languages which he is obliged to learn and from the countries in which he serves in garrison in time of peace. In him are found the perseverance of the German, the charm of the Slav, the Austro-Hungarian pride, and the careless Latin gayety.

The soldier undergoes the same influences as the officer, his mentality is a curious mixture of traits of character and habits which might appear irreconcilable. He has a receptive mind, ready enthusiasm tempered by a little Oriental fatalism, he is tenacious and not very susceptible to discouragement. A very lively appreciation of his rights does not make him forget his responsibilities. His chiefs are acquainted with his rather touchy pride and know how to utilize it for the good of the service. Watch him march: his step is slow without being heavy, his movements are easy without rigidity or nervousness; flexibility thruout.

North, south and east meet in the Austro-Hungarian ranks. They combine to produce a remarkable type of soldier.

The Austro-Russian Front

The Austrian fronts are very different from the western front. The war takes on quite another aspect there.

In Galicia and Russian Poland, the armies are displaced rather frequently, and the fronts are fixed absolutely only during the winter months. The distance which separates hostile trenches is, in general, much greater than in the north of France. It is often several kilometers, with outposts pushed forward more than a kilometer on both sides.

In Serbia, there was war of movement, in open country; on the Isonzo and in the Alps, mountain warfare.

The beginning of the Galician campaign, in 1914, had the character of a war of movement, then the front became fixed in the Carpathians until the resumption of the Austro-German offensive which ended in the expulsion of the Russians from Galicia. Since then trench warfare has been resumed in Bukovina,

EUROPEAN WAR—Continued

on the Sereth and the Styr, to speak only of the Austro-Hungarian fronts. But here again, the operations differ in many respects from those in the west. There is gain or loss of kilometers in the east, where meters, or at most, hundreds of meters, are talked of in the west.

Trenches.—The types of trenches are as varied as the nature of the soil. In general, profiles buried about two meters, sinuous trace, bomb-proof of logs covered by a meter of earth. In the sandy regions of Russian Poland, sand-bags are the only possible revetment. Wood, abundant in some regions, is also much used for revetment. No shelters in the bank itself; they are below the level of the trench and hold 8 or 10 men.

On the Pruth, frequent inundations constitute a serious natural obstacle. On the Styr, two lines of positions, the stronger near the enemy.

Obstacles to the approach.—The assailant encounters first a field of mines 20 to 40 meters wide, then *trous de loup* with stakes, separated from the barbed wire entanglements by a metal fence, 1½ meters high. The wires are fastened to the foot of the stakes. After this comes a second very dense entanglement of wire close to the ground (stakes 20 to 30 cm.); hand grenades are placed on the ground, and a snare is made with slip-knot; the foot is caught in the rope and the effort made by the man to free himself causes the explosion. Then comes a glacis of 20 to 30 meters and finally the trench.

All the openings for the circulation of patrols are closed with *chevaux de frise.* When the hostile artillery has destroyed the obstacles, *chevaux de frise* are thrown out from the inside of the trench.

Measures of Security.—1. Each company pushes forward a picket; an officer or cadet and 20 men, at 800-1200 paces. It is relieved every night. These pickets are connected by telephone with the company commander and communicate with the adjacent pickets by continual patrols.

2. Each company has one or two listening posts 400 or 500 meters to the front: a non-commissioned officer and two to four men. They do not try to intrench but are masked. They are withdrawn during the day.

The Combat of Nowo-Aleksiniec (26 and 27 Sept, 1915).—This town is on the Galicia frontier, 30 km. north of Tarnopol.

The Austro-Hungarians attacked on a front of about 4 km.

The deployment was made under cover of a line of wooded heights and in complete silence. Not a patrol, not a man went beyond the edge of the forest.

The affair began by violent artillery fire; the Austrian batteries fired on the hostile infantry. No artillery duel. This fire preparation lasted about 30 minutes; it was followed by absolute silence. The Austro-Hungarian infantry left their cover suddenly in long lines of skirmishers and progressed by rushes, by sections or by whole companies.

The infantry and machine-guns of the assailant opened fire at 1000 m. from the enemy. The forward movement was continuous in spite of the Russian artillery fire, which swept particularly the ground over which the reserves were advancing. The latter were deployed in several lines, following one another at from 300-500 meters, profiting by the folds of the ground for shelter and to rest between rushes.

About two hours from the time when the skirmishers left their cover, the first line reached the first Russian trench, cheers were heard, and, with the aid of field-glasses, one could see the defenders throw up their hands; the blue line passed on and reached the second trench. Half an hour later the affair was over. The artillery of the attack ceased firing, not being able to support the infantry any longer without the risk of causing losses in it; but no battery went forward.

From the position of the army corps staff, one could follow all the phases of the combat. The field telephone functioned regularly, connecting the corps commander with the artillery commander and the divisions, except that communication with the divisions of the first line was interrupted as soon as the forward movement was begun.

The Russian Soldier.—Judging by the numerous prison camps I have had the opportunity of visiting, the Russian soldier is docile, respectful and well-disciplined. He preserves in captivity his military appearance, renders the honors with punctiliousness and executes orders punctually. But he is apathetic and careless, external circumstances have little influence on him. He is not easily demoralized, but he lacks spirit and enthusiasm.

At the end of 1915 the infantry seemed to have gone down in quality. It was very short of subalterns (one or two officers per company). The reservists were poorly trained, because there was a lack of instructor personnel. Inexhaustible resources in men did not compensate for the mediocre preparation of the new levies. It is hard to get enough non-commissioned officers because of the great proportion of illiterates (80%) and the practical non-existence of a cultivated middle class.

However, there may be surprises in store for Russia's adversaries, who are accustomed to considering her as incapable of an offensive return.

At the Austrian officers' mess, I have heard the Russian army, and especially the Cossacks, highly praised. The Cossacks are very skillful in taking advantage of the terrain. Their patrols are surprisingly bold and scout well, picking up the enemy's tracks on the ground, like Indians. Reconnoitering parties, of the strength of a *sotnia,* attack boldly, on occasion, isolated detachments and wagon trains and penetrate the zone of the line of communications, where they set fire to stores and villages.

At the end of September, 1915, important masses of cavalry met at Kolki, on the Styr. Entire divisions charged each other in epic style, as in the time of Murat and Lasalle. An Austrian major of hussars, with whom I talked, did not conceal his admiration for the

mobility of the Russian cavalry. After the charge each man gallops towards a rallying-point designated in advance and the squadrons are reformed in the twinkling of an eye under the protection of the horse batteries.

Fighting on foot, the Cossacks can put 90% of their carbines on the line, thanks to the special training of the horses, which remain quietly in place under guard of a few men. These horses are ugly, bony, with coarse coats, short backs and falling croups; in repose they appear to be without temperament; in movement they are transformed by their fine gaits. Their endurance is extraordinary.

In the autumn of 1915, the armament of the Russians was very inferior to what it had been at the beginning of the 1914 offensive. New formations of infantry were armed with Winchester rifles and even with the old single-shot Berdan. The supplying of ammunition by the United States was beginning; among the enormous masses of ammunition abandoned on the battlefield, there was much of American origin.

The artillery was inferior in number to that of the Austrians and insufficiently supplied with ammunition; for the Russians had lost a considerable number of guns in their retreat. There was a lack of heavy guns; the 150 cm. guns found at Lutsk and Dubno were of an old pattern.

Everything had to be made over. The results of this reconstruction are being seen at the present time on the Galician front.

Przemysl.—The forts of Przemysl were built about 1893-4 and are about 10 to 15 km. from the center of the city. They underwent a bombardment in October, 1914; the Russians were obliged to raise the siege then. The second Russian offensive, from January to March, 1915, ended with the complete investment of the place and the capitulation of General Kusmanec's army. The Russian occupation lasted only two months and a half; on June 4, 1915, the Bavarians of General Kneusel and the 10th Austrian corps took possession of the city.

The forts are almost completely destroyed. The work of the artillery has been supplemented by the destruction made by the Austrian garrison before surrendering.

Galicia has suffered enormously from the war. Nothing can give an idea of the devastation. There is nothing left there except numberless wooden crosses on countless battlefields. Destruction has been on a vaster scale than in Belgium, where whole provinces have not suffered. On their retreat, the Russians left nothing. The population was forcibly evacuated to the interior of Russia; those who could escape deportation took refuge in Hungary. Over a stretch of 300 km. I did not see a single village spared.

The strangest part is that the Russians applied this same process in their own country; Wolhynia had the same fate.

These countries have become deserts. The Poles of Galicia have bad recollections of the Russian occupation of 1914-15. It is not to be wondered at that they welcomed with enthusiasm the Austro-Hungarian armies of Böhm-Ermolli and Puhallo. It meant deliverance for them. There is no doubt on this point; the Russians have alienated the sympathies of the Galicians. Terror has engendered hatred. I have been assured that things might have been different if the invader had known how to go about it. Nicholas Nicolaievitch did not try to understand this.

II.

IN SERBIA WITH THE ARMY OF KOVESS

The Taking of Belgrade.—When suddenly, on the 5th of October, 1915, the Austrian and German heavy artillery, in position behind Semlin, on the left bank of the Danube, opened fire on Belgrade, it was a complete surprise for the Serbs. For an entire day, the cannon of the defense were silent.

In the night of the 6th-7th, the first Austrian battalions crossed the river and landed at the foot of the citadel, about 5 o'clock in the morning.

The Serbian batteries suddenly unmasked and made the crossing of the river impossible; several transports were sunk. The operation had to be interrupted till dark. The battalion which had landed was not in a very enviable situation, ten meters from the defensive works, under a violent machine-gun fire and with no hope of being supported for 36 hours.

All during the day of Oct 7 the Austrian and German heavy artillery concentrated their fire on the citadel and the works along the river. A Serbian battery of four 150 mm. French naval guns was silenced.

The search-lights reached by shells had ceased lighting the banks; to replace them the Serbs set fire to the factories in the vicinity of the railroad station. This fire illuminated the Danube for two days.

In the evening of the 7th the crossing of the troops began again in spite of the violence of the bombardment. An Austrian brigade succeeded in crossing the Danube, and the Germans crossed the Save. A flotilla of monitors supported the infantry.

At dawn on the 8th, the 8th corps scaled the north escarpments of the fortress and seized the eastern quarters after a desperate street fight, in which machine-guns and hand grenades played a great part.

On Oct 9, Austrian troops penetrated the ruins of the citadel, while the Germans advanced thru the west of the city. There was much fighting in the Turkish quarter, where there was a house-to-house combat.

The siege of Belgrade had lasted five days. I have said that the Serbs were surprised by the sudden attack. They were absolutely ignorant of the great movements of troops thru Hungary and the concentration of Kövess' army between Semlin and Orsova. The three French aviators stationed at Belgrade in September had been recalled to Salonika. The posts along the Danube and the Save announced nothing abnormal on the left bank.

The Serbs counted a great deal on the help of the Allies; the latter had sent only a few guns, an English

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battery and a French battery.

Nevertheless, the defenders were heroic. There were few prisoners, for the Serbs refused to surrender and got themselves killed where they stood. On their side, the assailants had enormous difficulties to surmount. To be convinced of it one has only to glance at the river, one to two km. wide, and at the abrupt rock from which the citadel rises.

This citadel was built in the 17th century, and its bastions *à la Vauban* are not made to resist the 305 and 420 cm. guns.

* * * * * *

The Serb is a first-rate soldier. I have often heard Austro-Hungarian officers say that he is a hero. Of medium height, often blond, but with a brown skin, he is a southern Slav, more lively and less heavy than his Russian brother. He is sober and hardy. He has all the qualities of the peasant races, stubborn patience, fidelity, the sense of direction, respect for authority, and that love of the soil which inspires the most noble actions.

I have heard it said that, between the victorious campaign of 1914 and that less fortunate of 1915, the Serbian soldier had gone down somewhat in quality and that his power of resistance was no longer the same for the following reasons:

1. The epidemic of typhus which has raged in the country took away 30,000 men from the army.

2. The losses of the 1914 campaign have not been compensated, for of the 120,000 recruits of the class of '98-'99 60,000 were new Serbs (Macedonians, Bulgars, Albanians, Arnauts, Turks). These people fought without enthusiasm, many surrendered or deserted.

3. Sixty per cent. of the officers of the active army had fallen in 1914. Vacancies were filled by hastily instructed reserve officers, 4200 of them in the spring of 1915.

4. Four years of continued war had exhausted the country.

5. Numerical superiority of the adversary.

6. Moral depression caused by the lack of help from the Entente Powers. The result was great discontent, which manifested itself in certain corps by acts of rebellion. To encourage their men each day, the officers were obliged to announce the arrival of the Allies for the next day, and each day the disappointment was more cruel.

7. Lack of heavy artillery. The Serbs possessed nothing but a few 150 cm. guns; the devastating effect of the 305 and 420 cm. Austro-German guns demoralized them. Prisoners that I saw were all a prey to nervous excitement (trembling, stammering, loss of memory), caused by the heavy gun fire.

8. Lack of aviators.

The strength of the Serbian army in October, 1915, was about 220,000 men.

Combats During the Pursuit

In these successive combats, the Austro-Hungarian infantry would advance from crest to crest, in little groups or even individually. At each new position, supports for the rifle were arranged, but the rapidity of the forward movement did not permit of entrenching.

The Serbian infantry, in withdrawing, took advantage of the terrain very skillfully. It avoided becoming seriously engaged. The successive positions were prepared in advance and defended just long enough to force the enemy to attack them. The Austrians had the impression of facing an intangible adversary. They almost always found the position evacuated when they got there. As a rule, the Serbian infantry fires volleys, which produce a characteristic noise like tearing canvas. When advancing, officers and non-commissioned officers march behind the line of skirmishers; when retiring, in front.

They were armed with rifles of many different patterns. There were Mausers, guns taken from the Turks in 1912; Russian rifles, alongside the Serbian issue rifle, all of different calibers. The regiments of the first levy were dressed and equipped in a uniform way. Among those raised later there was a certain variety of uniform; there were even French blouses and English overcoats. The soldier prefers the national footwear, the "opanken," turned up at the toe, to the laced marching shoe, which hurts his feet.

The artillery was used very judiciously. It sought, with great boldness, to fire at the enemy's flank, unmasking one or several batteries at the moment of breaking off the combat.

The effect of large artillery projectiles on the points of support of the defense was formidable. Nothing stood before it; in the trenches of Mount Avala (20 km. south of Belgrade) corpses were seen lying side by side with no apparent wounds. Entire companies had been asphyxiated by the displacement of air produced by the bursting of the 305 and 420 cm. shells. Forests were cut down as by a gigantic cyclone.

The Austro-German forces maintained constant contact with the retreating enemy by means of detached squadrons. The distance which separated the two armies was relatively small; strong infantry patrols (an officer and a half section) were sufficient to cover the forward movement.

The service of the line of communications had to struggle with enormous difficulties on account of the bad condition of the roads (sticky mud in which the wagons sank to the hubs, the horses sometimes to their bellies). Nevertheless, the army wagon-trains operated with regularity. Columns ten kilometers long marched without disorder.

The Austrians use as ration-and-baggage wagons the light vehicles of the country, and, for the transportation of ammunition, two-wheeled carts, drawn by small Bosnian horses, hardy, easy to feed (they were not acquainted with oats), and requiring a minimum of care. The Germans were forced to make for the Serbian campaign a two-wheeled cart; their heavy wagons bogged down in the Serbian mud.

I asked a Serbian prisoner what he thought of the

situation of his country. He replied: "Serbia is at the end of her strength. We have been at war for three years; the country is exhausted. The army has melted away, and yet the resistance may still be long, for, to conquer the Serb, you have to kill him. The army has confidence only in itself; we, the officers, have ceased to believe in Allied help."

[Diary of the War. By A. F. B. *Revista de Artilharia,* Dec-Jan, 1916-17. 4000 words.]

(A diary of the war by theaters for Feb 1st to 15th, 1915.)

[War Notes. By Captain H. M. Johnstone, R.E. (retired). *United Service Magazine,* April, '17. 4000 words.]

The chief object of the German Command in directing the Turks into Persia was to gain control of that country for the purpose of raising trouble for England in Afghanistan and India, a project whose failure must have been recognized before this. Consequently, the Persian theater at once falls into a very subordinate place, and by far the chief mass of troops has long been required to hold back the persistent fighters hailing from the Persian Gulf, and to watch the Russian forces that are beginning to stir in the regions of Mush and Lake Van.

The Turk is credited with a maximum of fifty divisions, but he has to fight in too many fields, where the forces required are substantial. In Asia there are Mesopotamia, Persia, Kurdistan, Armenia and Anatolia, tending to amalgamate into one. Six divisions may be ascribed to Mesopotamia and Persia, and the Russians say there are at least sixteen divisions facing them on the semicircle that sweeps around from Lake Van to Trebizond thru Erzingjan. In the Adana neighborhood the Bagdad railway is uncomfortably near the sea and the Turks must also prevent Russian landing parties from operating against the coal regions on the Black Sea Coast. Four or five divisions must thus be absorbed and Turkey has still to provide for the Dardanelles and the Bosphorus, to keep a reserve at the capital, to help Bulgaria in the Dobrudja and the Austrians in Wallachia, and to provide Bothmer with two or three needed divisions on the Gnila Lipa and the Narajovka.

[Chronicle of the War. Situation on Nov 5. *Memorial de Caballería,* Nov, '16. 3300 words. 1 map.]

(This is a good condensed account of the European war by theaters. It appears monthly in this publication.)

[Chronicle of the War. *Memorial de Caballería,* May, '17. 6400 words. 1 sketch.]

(This includes a resumé of operations on all fronts down to May 1. The following are extracted:)

Russia

The breaking up of the Russian army continues. It may be said that the campaign of the Russians ended on the day of the revolution. The Austro-Germans, from their own lines, are content to witness the disorganization of an army that was once a mirror of military virtues. They doubtless consider that an offensive at this time would probably unite public sentiment in Russia against them. It is possible that the near future may witness an offensive in Eastern Galicia and Bukowina with the object, not to destroy the Russians, but simply to push them back to the frontier. A separate peace may be concluded before this can be brought about.

There is nothing to report on this front other than light cannonading and the activities of reconnoitering patrols.

Rumania

Operations in Moldavia ceased with the destruction of the Rumanian army and the withdrawal of the Russians. A tentative advance by a small Russo-Rumanian column east of the Sereth was easily repulsed.

Mesopotamia

Unconfirmed news of British victories arrive from time to time. On Mar 31 Gen. Maude was 58 kilometers above Bagdad, and on Apr 30 he was a little north of Samara, distant about 100 kilometers from the capital, so that in one month he has advanced about 50 kilometers. The resistance of the Turks has strengthened. The expansive power of the English invasion is about at its limit. It is said that Marshal von Mackensen has been named Commander-in-Chief of the Ottoman Army.

The Russian divisions moving from Persia against the Turkish frontier have been halted. Irregular Persian forces are menacing their lines of communications. The English can no longer count upon Russian aid from this direction.

Palestine

English vessels assisted in an action that occurred near the shore at Gaza. Questions of transportation and supplies and the climate are the principal obstacles that the English encounter here. They do not appear to have at hand sufficient troops and supplies to develop an active campaign in this region.

The War at Sea

German destroyers have been active in the Straits of Dover. Calais and other cities have been bombarded repeatedly and ships torpedoed in nearby waters. These acts are in striking contrast with the security enjoyed by the German secondary base at *Zeebrugge.*

Four hundred and fifty-one vessels were sunk by submarines in March. In the first two months of the submarine blockade the losses aggregated over 1,600,000 tons. Judging by the manifestations of the British Admiralty, the losses were still greater in April. It is worthy of note that one of the zones of greatest activity of the submarines is the entrance to the Straits of Gibraltar from the Atlantic, notwithstanding the presence here of many English units of all classes. The question of food supply is becoming alarming in and Italy. This hardly remedies the penury of the Central Powers, in whose dominions the scarcity is greatest. The shortage of food supplies will probably continue until the next harvest. There is no indication

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that the naval co-operation of the Americans has contributed to change the situation. No efficacious remedy against the submarine has been discovered as yet.

Resumé of the General Situation

It could almost be said that the war is over. Russia is out of the combat; Austria by successes in the Balkans is more than repaid for losses in Galicia; Bulgaria is altogether victorious; Italy is quiescent and without hope of material gain; Germany has reached the culminating point of her ambitions and will try to hold what she has until the day of negotiations; Turkey has met defeat in Armenia and Mesopotamia, but her capital is safe. Only England and France continue to fight. Why does the war continue? Two forces only maintain the life of the struggle; the submarines against the nations of the Entente and the French and English armies against Germany. The French-English offensive is due principally to the desire to keep hope alive in Russia, and to prevent the latter from concluding a separate peace.

[Germany's Lost Opportunity. By Arthur Pollen. *Land and Water*, June 14, '17. 3000 words.]

The naval war took the Germans completely by surprise. The one flaw in their scheme for the conquest of all Europe was that they left England out of their calculations as a probable and immediate combatant. Almost no preparation for a sea war with Great Britain had been made so that once the fleet was mobilized and at its war stations, German sea power perished off the outer seas as effectually as if every surface ship had been incontinently sunk. It was not British strength at sea that made the Germans impotent. They were confounded as much by surprise as by superior power. Actually the disparity between the main forces of the two Powers was not such as to have made victory impossible for Germany, had she been free to choose her own methods and her own time for making war. It is not certain that a successful attack upon England would have been beyond the resources of those who planned the great European war, had they, from the first, grasped the elementary truth that it was necessary to their larger scheme. To conquer Europe it would not be necessary to crush England finally and altogether. All that was required was to prevent her interference for about six months, and this, it seems, was far from being a thing beyond the enemy's capacity to achieve. The essentials of the attack are easy to tabulate: 1st, Concentration in the North Sea of the German and Austrian fleets (a review at Kiel would have been a plausible excuse for this); 2d, a surprise attack by submarines upon the British Fleet, which in July was anchored in the Solent. This would have reduced effectually British superiority in capital ships; 3d, the sending of five-score or more of armed merchant ships to the distant trade routes under disguise as peaceful traders; 4th, the despatch of two-score or more destroyers to the approaches of the channel and the western ports with orders to sink every British ship at sight.

The two things taken together—the assassination of the fleet, and the wholesale murder of the merchant marine—must have thrown Great Britain into a paroxysm of grief and panic.

A raiding force, secretly organized and skilfully thrown in upon the utterly undefended and now indefensible Eastern Coast, would have completed the discomfiture. Looking at Germany in the light of two years of her conduct it can be seen that it was not scruple or conscience or any decent regard for the judgment of mankind that made her overlook the first essential of success. Sir Frederick Pollock has put the truth in this matter into these terms: *"The Germans will go down to history as people who foresaw everything except what actually happened, and calculated everything except its cost to themselves."*

[Chronicle of the War. By A. *Memorial de Caballeria*, Aug, '17. 4000 words.]

(This article summarizes the situation on the Western, Eastern, Italian and Macedonian fronts, and also in Palestine, Mesopotamia, and the Caucasus, on the first of August.

The conclusion is that the belligerents of both sides hesitate to take decisive action for fear of compromising the bulk of their forces, and that the general tenor of the struggle in the immediate future will reflect the vacillation now being shown.)

[The World War. The Military Events in August, 1917. By Maj. Guggisberg. *Schweiz. Monatschrift aller Waffen*, Sept, '17. 2500 words.]

In his report on the battles at Ypres, in October and November, 1914, Sir John French regretted the impossibility of seizing the Lys bridge. His troops were involved in attacking Lille and in acting as rear-guard for the Belgian troops withdrawing from Antwerp. He therefore effected a junction of the 7th Division and the 1st Corps with the Belgian army and the 2nd and 3rd Corps, and defended Ypres. He succeeded in preventing the capture of Calais. A war of position on the Yser Canal followed. The German offensive of Apr 22, 1915, moved the line. Before this date the line followed the Yser from the sea to Steenstraete; thence the line bent eastward around Ypres, passing north of Langemarck and south of Poelcapelle; thence southeastward between Wallemolen and Passchendaele; thence south on the Mosselmarkt-Broodseinde-Becelaere road; south of Zonnebeke it turned southeast thru the Herentage Wood, and reached the canal again at Oosthoek. In the battles of April and May the line was altered. The Allies were thrown back on the line Het Sas-St. Julien; Germans took Lizerne; English withdrew on the line St. Julien-Fortuyn-Frezenberg-Zillebeke. French attributed the withdrawal to the use of poison gas by the Germans.

In June, 1917, the English attacked the Lys salient, and took Wytschaete and Messines, compelling the Germans to withdraw on the line Hollebeke-la Bassee-Ville, south of Warneton. The possession of the plateau of Messines was necessary to the English before they could attack north and east of Ypres. Artil-

lery preparation for two weeks heralded an attack between the sea and the Lys. This attack had to be made on a well prepared position held by seasoned troops. A prior concentric attack on Bixschoote and Hooge had made the task somewhat easier. The new attack began at 3:50 a. m., July 31, on the 30 kilometer front Steenstraete-Warneton. The French, who had relieved the Belgians on the left, crossed the canal and took Bixschoote. From the south the English took Pilkelm. On the right diverging English columns advanced on the roads leading to Langemarck, Zonnebeke, and Gheluvelt. The English also took Verlorenhoek, Hollebeke, and la Basse-Ville. Aug 1st and 2nd the English gained considerable ground, which was lost as a result of German counter-attacks. Germans retook St. Julien and points on the Ypres-Roulers railroad.

The English also attacked near Lens. In the Loos-Lens sector Canadians took Hill 70, which was of great tactical importance. Lens is surrounded by hills, some of which were taken earlier, but an attack on the town was impossible until Hill 70 on the north and Hill 72 on the south were captured. Hill 70 gave the English a field of view over the coal region from Pont a Vendin, and was valuable as an observation point for artillery. In the vicinity of Loos the Canadians penetrated to the third line of the first German position, but were thrown back. On Aug 16 the English attacked on a front of 18 kilometers between Bixschoote and Wytschaete. The result was the capture of Langemarck and the strip of land between Lootbeek and the Brook of St. Jean.

The evacuation of Moldavia did not proceed as quickly as expected. The first reason was the exhaustion of the German troops, who had pressed forward fighting from Kalusz and the Tartar Pass to the Russian boundary. The second reason was the obstinate Russian and Rumanian defense. Nevertheless a retrograde movement of the inner wings of the Rumanian 2nd and Russian 4th Armies, south of the Trotus and from the Putna, to the northeast, was reported. Mackensen's troops attacked west of the Sereth, but the Allies may be able to stem the tide.

A well-timed French offensive was begun Aug 20 at Verdun on both sides of the Meuse. The French captured the whole Maasschleife ridge on the right bank, and later Hill 344 east of Samognieux, and the farm of Mormont. On the left bank they took Dead Man's Hill and the Wood of Avocourt, and Hill 304. The Germans withdrew to the Forges Brook. The Germans are now almost on their line of February, 1916. On the left bank of the Meuse the first French position ran along the Forges; the second extended from the Wood of Avocourt over Hill 304 and Dead Man's Hill to the Cote de l'Oie; the third included Hill 310, Fort Bois-Borrus, and Fort de Marre. On the right bank the first extended from Brabant to the Meuse, thence thru Consenvoie, Haumont, des Caures, and Herbebois Woods to Ornes, where it turned south. The second was on the line Samognieux-Hill 344-Mormont-Beaumont-Les Fosses-Caurieres Wood. The third ran from Bras to the Meuse opposite Fort Douaumont, thence to Forts Hardaumont and Vaux. It thus appears that the Germans only penetrated the third line on the right bank, at Douaumont (February, 1916), and Vaux (June, 1916). When the Somme battle began in July, 1916, the Germans attacked at Verdun, but later lost the two forts, and were thrown back to Hill 378 and Bezonvaux. The French offensive of Aug 20, 1917, cost them the terrain south of the Forges.

At the same time as the Verdun fight, the Italians attacked from Tolmein to the sea on a 60 kilometer front. On the Karst and Bainsizza plateaus they forced the Austrians to withdraw. This was due to the Italian success at Verh, where they attacked after throwing fourteen bridges over the Isonzo. The capture of Monte Santo made Monte San Gabriele of tactical importance. The latter is the pivot of the movement on the Bainsizza Plateau. On the right they advanced along the Jamiano-Brestovica road, and took Selo and Corite. The line therefore runs from Costanjevica to Brestovica and Medeazza. The capture of Hermada Hill, which commands the sea road and the Brestovica road, will probably follow.

[A Review of the Third Year of the War. By Hilaire Belloc. *Land and Water*, Aug 2, '17. 6400 words.]

The third year of the war (calculating from the first military act of hostilities), came to a close on Aug 4, 1917. The details of the year resolve themselves clearly into two parts very sharply defined by the outbreak of the Russian Revolution. In the first part, during which every member of the Grand Alliance was working in concert with the rest, the pressure steadily increased upon the enemy until he, seeing disaster inevitable in 1917, called for peace, and failing to obtain it, took to methods of desperation. The Russian Revolution modified these conditions to the extent that the weight of the war was thrown upon the Western Powers.

Upon Dec 12 the German Government solemnly asked for peace. The appeal failed and there immediately followed in December and January, 1916-1917, those new dispositions which were due to a feeling of desperation. The 1918 class was called up; a great number of new divisions were formed; and most important of all, the German Government declared its determination to remove all remaining restrictions from its use of the submarine. The German decision so to use the submarine may be compared to the declaration of the Terror during the French Revolution. It was the most extreme act of which the nation at war was capable and it was a novel effect in the story of European warfare.

The enemy was prepared to risk a rupture with America upon two calculations, the one right, the other wrong.

He calculated rightly that his chances in 1917 were already so bad that he might risk their increase on the chance of really weakening the tonnage of the world. His false calculation was that the variety of American opinion, the large body of American citizens Ger-

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man in origin, and many other factors taken as a whole, would keep America out of the war.

On Mar 16 the event took place which changed the whole face of the war. On this date Western Europe received a message from the new Revolutionary Government of Russia that the Czar had lost his throne and was a prisoner, and that the Government to which foreign Allied Governments must address themselves was the Ministry responsible to the Duma. From the moment that the Revolution declared itself the enemy began withdrawing men and munitionment from the Eastern front.

He was thus able to reinforce to some extent his Western front, while his Eastern front became a sort of "rest camp" or "especially quiet sector" to which could be sent troops who had suffered from the superiority of the Western Allies. It is a mistake, however, to think that the enemy can weaken his forces on the Eastern front below a certain not inconsiderable minimum. This line is approximately a thousand miles in length. Under present conditions it must be guarded and by such a force, that should the Russians resume the offensive, a serious rupture could be prevented.

Unfortunately the largest sector of the "siege ring" has ceased to wear down the enemy and, excepting the offensive by Brusiloff in July against Brzezany, there has for months been but little pressure exercised upon all the 1000 miles from the Baltic to the Black Sea. Brusiloff's effort gave promise of great success until certain units but recently recruited from the Capital betrayed their trust and abandoned their positions. The withdrawal of the Russians is in full operation at the very close of the period under review.

WESTERN THEATER

See also

Arras, Battle of
Belgium—Army
Cavalry—Use of in European war
Charmes Gap, Battle of
Marne, Battle of the
Mons, Battle of
St. Eloi, Battle of
Somme, Battle of the
Verdun, Battle of
Wytschaete Ridge, Battle of

[German Orders of Battle on the Western Front. *Rev. Mil. Suisse*, May, '16. 2400 words. Maps.]

(Gives the location of German corps in the offensive of 1914, and up to the autumn of 1915.)

[The Campaign of 1914 in France. By Champaubert. *Jour. Royal Artillery*, Sept, '16. 7000 words. 8 maps.]

(Translated from the French by Major H. T. Hawkins, R.G.A., with the kind permission of Messrs. Berger-Levrault, and *Le Journal l'Illustration*, Paris.)

Strategic Doctrine in France and Germany

After the experiences of 1870, France had at first no other thought than that of protecting herself from another invasion. She wanted to safeguard her frontier by a barrier of fortresses, and therefore the fortified systems of the Meuse (Verdun-Toul) and the Moselle (Epinal-Belfort) were constructed, which left open but two narrow gaps between Luxembourg and Switzerland.

During this epoch, Moltke busied himself with developing and perfecting the network of railways leading into Alsace-Lorraine. The veteran marshal always expressed contempt for fortifications and entrenched camps, "the history of which," he said, "is mixed up with that of capitulations." He attached importance only to the rapid concentration of armies on the frontier.

The death of Moltke preceded by a few months the conclusion of the Franco-Russian alliance, which presented a delicate problem to the general staff of Berlin. The position of Germany between her two neighbors east and west was dangerous. But due to the slowness of the Russian mobilization and concentration, badly served by insufficient communications, Germany, by throwing the mass of her forces against France, could endeavor to put her out of the running as soon as possible, and then return to the eastern frontier against the slower moving Russians. It was necessary to success that the offensive be briskly led and be carried thru without stop to a decisive finish. The narrow gaps in the French frontier systems were not sufficient to turn those works with success, and furthermore, the German-French frontier was not of sufficient length to permit of the strategic development of the large German forces. The narrow frontier would have reduced the war to a combat of attrition, unsuitable for arriving at an early decision. Only a wide sweeping movement thru neutral countries would avoid the French frontier fortresses.

These considerations militated in favor of an offensive thru Belgium and Luxembourg. A glance at the map also shows that the route of the greatest part of the German army passes thru the same region. The territories from which eight German army corps are drawn lie on a level with the French frontier, those of the seventeen others extend more to the north, and the shortest route to Paris from the chief town of each of the latter corps areas enters France thru Belgium and Luxembourg. Recognizing the above facts, the German General Staff, in 1893, began to improve the railway lines of Rhenish Prussia ending at the Belgian frontier, thus showing their intention to move further north the zone of concentration of part of their forces. At the same time the fortification of Alsace-Lorraine was undertaken, which would allow them, if necessary, to economize troops in those provinces in order to swell the mass operating thru Belgium.

These undertakings soon enlightened the best soldiers in Brussels and Paris, but there were differences of opinion as to the magnitude of the German columns thru Belgium. The Belgian opinion was, that the German wave would cover the entire country passing north of the Meuse, while many prominent French

writers considered that the principal attack would come from Lorraine, with a flank guard thru southern Belgium, without crossing or even reaching the line Liége-Namur.

On the side of the French, offensive principles made them seek to gain the initiative, but as there was no intention of violating the neutrality of Belgium, there was nothing else to do but dispose an important fraction of their forces towards Alsace-Lorraine.

Grouping of the Armies and First Operations

Thus the strategical doctrines of the two nations were to give a different character to the operations of their armies. The Germans were to try for a decision by a vast movement pivoted on Mont Donon, with its marching wing across the Sambre and the Oise, while they remained on the defensive in Alsace. The French wanted to attack without delay on the whole Franco-German frontier.

The armies were grouped as follows:

France distributed her first line troops in five armies; the 1st (Dubail) along the Vosges Mountains from Switzerland to Mont Donon; the 2nd (de Castelnau) from Mont Donon to Metz; the 3rd (Ruffey) opposite the fortified sector, Metz-Thionville; the 4th and 5th (Langle de Cary and Lenrezac) formed along the Belgian frontier; and the British Army, two corps strong (French), formed the left of the line.

Germany, who put into her first line not only her active and reserve corps, but also territorial regiments, for the first engagements disposed of forty-four corps divided into nine armies. One of the armies, the 8th (von Deimling), much weaker than the others, was to remain on the defensive behind the Vosges Mountains. All the rest were concentrated between Aix-la Chapelle and Strasbourg to converge on the northeastern frontier of France. These were from right to left; 1st (von Kluck), 2nd (von Bülow), 3rd (von Hausen), 4th (Duke of Württemberg), 5th (Crown Prince of Prussia), 6th (Crown Prince of Bavaria), and 7th (von Heeringen). In advance of the right wing was the Army of the Meuse (von Emmich) to open the way thru Belgium.

On the night of the 3-4 of August, the leading German troops crossed into Belgium and next day began an attack on Liége, which was repulsed. General von Emmich then had to wait for heavy artillery to reduce the place, the last fort falling on the 15th of August.

At the same time, French troops penetrated into Alsace. General Dubail seized the passes of the Vosges and on the 8th of August occupied Mulhouse. In Lorraine, General de Castelnau, after two checks at Lagarde, occupied the line Delme-Morhange-Sarrebourg on the 18th of August. And lastly the French left wing advanced.

From the 10th of August, the French left wing made dispositions for entering Belgium. The 3rd Army left its position in front of Metz and faced northeast, its right on the heights of Longwy. This allowed the 4th Army to prolong the line by pivoting on its own left. The 5th Army was placed between the Meuse and the Sambre, and the British, on the 23rd of August, arrived in position between the Sambre and the Scheldt. The first contacts were favorable to the French.

The first general engagement and the French retreat. The real German army, after having detrained on the line Aix la Chapelle-Malmedy-Trèves-Metz-Strasbourg, advanced on an imposing front. Von Kluck, without waiting for the outcome of the attack on Liége, crossed the Meuse below Liége, beat the Belgians at Aerschot, and occupied Brussels on the 20th of August. Von Bülow, coming from Eupen, crossed the Meuse at Huy, and advanced toward the Sambre between Charleroi and Namur. Von Hausen and the Duke of Württemberg, from the base Malmedy-St. Vith, crossed the Ardennes on Dinant and Neufchâteau. To their left was the Crown Prince of Prussia from Trèves and Metz thru Luxembourg.

East of Metz, the Crown Prince of Bavaria advanced against the front of de Castelnau's army, the left flank of which was threatened by troops coming from Metz and the right by the advance of von Heeringen towards Sarrebourg. The general engagement in this region began on the 20th of August. The French were forced back and had to give up all the ground previously gained. The German advance was definitely stopped on the line of the Grand Couronné of Nancy and the Mortagne.

On the left wing, on the 21st and 22d of August, the French 3d and 4th Armies dashed themselves against the German columns advancing thru Belgian Luxembourg, but were thrown back to the frontier by superior numbers. This retreat uncovered the right of the 5th Army, which reached nearly to Namur. It fell back without much difficulty. The British, obliged to conform, and pressed heavily by the whole army of von Kluck, only disengaged itself with loss after falling back to near Landrecies and Cambrai.

The French retreat proceeded to the line Paris-Verdun and beyond, some vigorous thrusts tending to check the German pursuit.

A chief or ordinary capacity might have chosen a solid defensive position in rear of the old position, as for example, behind the Meuse or the Aisne; but the French commander-in-chief preferred to sacrifice a large zone of national territory in order to gain room to maneuver, and to meet the enemy next as an assailant. Thus by his preserving the French army intact, had the first German plan of overwhelming the French gone awry.

The Victory of the Marne.—The invading army came southwards. Its right wing turned to the southeast to avoid Paris, following one of the principles of its doctrine of war, that one should neglect geographical objectives, should consider only the field army of the enemy, and should leave it no intermission or rest until it is annihilated. The Germans could no longer carry out their favorite maneuver of envelopment. To get at the French army, they had to pass between the two strongholds of Paris and Verdun, and place themselves in danger of envelopment. Attributing the

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French retreat to complete demoralization, they could afford to take chances in order to capture or destroy the French army. General Joffre at first had not intended to stop until on the Seine, but on the 5th of September, seeing the enemy entangled between the two fortresses, he determined to pass to the offensive. The French line in Champagne had been reinforced by two new armies, the 6th and 7th, under Generals Maunoury and Foch, respectively.

The French were disposed as follows: the 3rd Army, under General Sarrail, rested on Verdun, facing west and was to fall on the left flank of the army of the Crown Prince; the center, composed of the 4th, 7th, 5th, and British Armies in that order from right to left, were to attack north along the front Vitry le Francois-Meaux; while the 6th Army on the extreme left, pivoting on Paris, was to face east and attack the German right wing in reverse on the Ourcq.

The battle of the Marne began on the 6th of September. The French gained ground from the start and by the 9th of September the retreat of the Germans was general. The French troops, wearied by weeks of constant marching and fighting, were unable to continue the pursuit very far, and the enemy profited by the respite to halt on the heights of the Aisne and to organize a defense between the Oise and the Meuse. Violent fighting took place along the new front; action crystallized there little by little, and the war of positions succeeded the war of movements.

From the Aisne to the Lys.—The battle of the Marne restored the balance of power between two adversaries. Neither appeared to be within reach of a decided victory. The Germans now began to employ the principles of the economy of forces. No general offensive at all points, but a defensive action in the center and an attempt with large forces at an envelopment at the wings.

The right flank of the main group of French armies rested on Verdun. A first German attempt at this flank, starting from Metz, was thrown back at Fort Troyon. A few days later a second attempt with larger forces (four army corps) and heavy artillery succeeded in reducing the fort of the Roman Camp on the 26th of September and in crossing the Meuse at St. Mihiel. This force was thrown back on the river, but retained a lodgment on the west bank at St. Mihiel.

Meanwhile against the French left, the Germans had collected all possible reinforcements and attempted to envelop that flank, but the French line was prolonged to meet the moves of the Germans, and this period of the campaign developed into what has been called "A race for the sea."

The Battle of Flanders.—The Germans now planned an offensive on both eastern and western fronts. Against the Russians, they prepared an invasion in five heavy columns with the assistance of the Austrians. In the west, they planned before the Allies reached the sea, a last attempt at envelopment with forces heavy enough to sweep aside all resistance. To accomplish the latter it was necessary first to clear up Belgium.

The Belgian Army was at Antwerp, holding the approaches to that entrenched camp as well as the crossings of the Lys and the middle Scheldt. The fall of Maubeuge made available the heavy siege guns of the Germans. On the 26th of September, these guns were in position and opened the bombardment of the southern sector of the entrenched camp of Antwerp. The Belgian Army maintained a passive defense. A breach was soon made in the outer girdle of forts which was occupied and held by the German infantry, while the guns were moved forward to batter down the second line. On the 9th of October, the Belgians evacuated Antwerp, retiring along the narrow strip of land between the Dutch frontier and the Scheldt River. When the Germans forced the crossing of Scheldt near Termonde, the greater part of the Belgian Army had passed in safety. The rear guard, cut off, entered neutral territory and was interned. The Germans lost the full fruits of their capture of Antwerp by attacking the forts on the south bank of the Scheldt before completing the investment on the north bank, thus allowing the main Belgian army to escape, and later to reassemble behind the Yser, and assist to dispute the last German attempt to turn the Allied left.

The Germans followed the Belgian retreat slowly; Ghent, Bruges, and Ostend fell into their hands without fighting. The Belgian Army went into position on the left bank of the Yser, and supported by some French troops, formed the left of the allied line. The Germans, with fresh troops, made a strong effort to break thru the Belgian line and force the crossing of the river. One regiment did succeed in crossing the river and in occupying Ramscapelle, but a counter attack by French reinforcements soon forced it to retire to the right bank. On the 28th of October, after fifteen days of unsuccessful assaults, the Germans gave up the attempt to break thru there and turn the allied line, and turned their attention to the salient at Ypres. The next day the Belgians broke the dykes and flooded the country in the vicinity of their front.

At the end of October, the Germans had concentrated strong forces opposite Ypres, among them two army corps of picked troops. On the 30th of October, the assaults on Ypres began and continued until the 15th of November without much success for the Germans. Losses were heavy and the fighting desperate. The battle culminated on the 11th of November with a particularly heavy assault, in the course of which the Prussian Guard pierced the British front and gained the outskirts of Ypres, but could not maintain itself there and gave way before the British counter attack.

The last six weeks of the year saw no general offensive against the French armies, but only local attacks of small scope. All disposable German elements were sent to the eastern front to reinforce the armies of Field Marshal von Hindenburg, to whom was confided the task of putting the Russian armies out of the field.

[The Salient of Beaucourt. By Hilaire Belloc. *Land and Water*, Oct 12, '16. 2300 words. 3 sketches.]

Two general types of salients have been noticed in

this the war of positions; the large one, which may roughly be called the strategical salient, and the small one which may be called the tactical salient. Between these two types there lies a doubtful category, and it is the examples within this doubtful category which have afforded some of the most interesting problems in the course of the war. Ypres is a good example. This salient was too large to be called a tactical salient, but when it was sufficiently pronounced to approach a semicircle in shape, it was discovered that this line was too bold. The losses by reverse fire were too serious and therefore about 18 months ago that salient was reduced. The form it finally took, an arc rather of 100 degrees than 180, was found to be stable.

The salient of Beaucourt is not acute. It describes a right angle. Every advance northward, however, from the positions of Courcelette, Le Sars, and Eaucourt L'Abbaye, now held by the British, renders the trace of the salient more acute. A fortnight ago it was about 120 degrees in rough measurement; a week ago it was something like 100 degrees. After the capture of Le Sars and the advance beyond that village, it sank to almost exactly 90 degrees and with every further advance the angle will become more acute. The base of the salient represents an extreme range. It is 13,000 yards from the positions just above Gommecourt to the foremost British positions in front of Le Sars. The real ranges are of course much more than this, because the batteries lie far behind the most advanced positions held. The salient therefore is not one so small in scale that it can be called tactical. Its degree of strength or vulnerability must be tested rather by conditions of ground. The topography of the country just north of the Ancre is such that a further advance from the present positions in front of Le Sars would uncover and enfilade the German battery positions behind the ridges of high ground, which here trend from northwest to southeast. This swing round towards the north uncovers, therefore, as it proceeds, all the best battery positions beyond the railway.

[The French Sector. By Hilaire Belloc. *Land and Water,* Oct 26, '16. 4400 words. 3 sketches.]

(The French offensive on the 20 mile front between Sailly-Sallisel and Chilly is discussed copiously and in detail. Sketches accompanying the article are frequently referred to. The omissions made at the request of the Press Bureau often interrupt the thread of the account.)

[The Extension of the British Line in France. *Sphere,* Jan 13, '17. 300 words.]

Since the French attack on Verdun, Dec 15, the most important military event on the western front is the taking over by the British of about ten miles of front from the French. The change was made desirable by the extension of the French front, due to the ground gained in the Somme offensive. The original junction point of the French and British, July 1, was near Maricourt, two miles north of the Somme. As the advance was made, the British line swung north to a position north of Combles. The line has now been taken over to Cléry, on the north bank of the Somme. The French line is still four times as long as the British line. The British right is now near Péronne. This position is surrounded by a network of waterways and is protected on the northwest by the ridge of Mont St. Quentin. It will hardly be captured without a desperate struggle.

[Verdun and the Somme. (From French sources.) By Major T. E. Compton. *Jour. Royal United Service Institution,* Feb, '17. 6000 words. 3 sketch maps.]

(An excellent account of the operations at Verdun and on the Somme, in considerable detail. This digest gives only a few of the salient points.—Ed.)

The attack on Verdun did not come as a surprise to the French, as deserters had declared that the Crown Prince was going to take the town and finish the war, so a French officer (Lt.-Col. Driant, son-in-law of Gen. Boulanger) wrote to a friend on Feb 20, 1915.

The Verdun forts were built in masonry in 1880, rebuilt in concrete in 1885, and in reinforced concrete in 1911. The French front completely protected the fortress, passing about 9 miles to the north and east of it and touching the Marne at St. Mihiel, 20 miles south of Verdun.

The attack, begun on Feb 21, had pushed the French back on the right of the Meuse to the outer line of detached forts by the 25th. The French Second Army, comprising four corps under Gen. Pétain, arrived at this time and saved the situation. The German attacks continued, and by the first week in June, with Forts Douaumont and Vaux and Damloup Battery lost and Fleury captured, the fall of Verdun seemed at hand. But the combined British and French attack on the Somme relieved the pressure. Douaumont was recaptured Oct 24 by Gen. Nivelle, who succeeded to the command of the Second Army on Apr 30. Fort Vaux was recaptured Nov 2.

(The author concludes after analysis that the German offensive was undertaken to use up the French reserves and so render an Allied offensive impossible, and that Verdun was selected as the point of attack because it was in front of the Crown Prince, and a striking success would restore the diminished popularity and increase the prestige of the heir presumptive.)

The attack on the Somme is to be regarded as an extremely necessary tactical diversion to relieve the pressure on Verdun, and in this sense the operations were completely successful.

(A general account of the operations on the Somme here follows. The German losses during these operations are put at 700,000, stating that the Germans admit 500,000.)

[Verdun Again. *Independent,* Feb 5, '17. 600 words.]

There are reiterated rumors that the Germans are now gathering a huge army and abundant munitions on the west front for an attempt to break the British or French lines. A small advance in France would affect public opinion more, and increase the chances of a

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favorable peace more than another defeat of Russia would. The renewal of German activity at Verdun, standing at the meeting point of the northern and eastern battle fronts, may presage a campaign in eastern France instead of on the Somme front. The Swiss government, evidently fearing that Germany may attempt an invasion of France thru Switzerland, has called out more troops to guard the Alsatian frontier.

[British Line Extended. *Army & Navy Gazette*, Mar 10, '17. 150 words.]

The British line is now twice its length 12 months ago. It reaches at least as far as the Roye sector, 20 miles from the Somme valley. The British are faced by nearly as many Germans as are the French.

[The German Withdrawal. *Independent*, Mar 12, '17. 500 words.]

The German withdrawal before Bapaume was evidently planned long ago and has been carried on secretly for some time. The old trenches and dugouts have been completely denuded of their furnishings, equipment and arms except the few machine guns left to keep up a show of resistance. The village church spires and clock towers that might serve as observation posts have been demolished. The traps laid for the British include mines exploded by trip wires or by a distant observer, spring guns set in the trenches, and even helmets left lying on the ground containing bombs set to explode at a touch.

[The War of Position on the West Front. Editorial. *La Guerra y Su Preparación*. Mar, '17. 150 words . 5 photographs.]

(The accompanying photographs, furnished by the French Minister of War, give a clear idea of the destructive effect of heavy artillery and of the peculiar trace of modern trenches.)

[Notes on European War. By the Editor, *Rev. del Círculo Militar*, Mar, '17. 1200 words.]

The English troops under General Maude have taken Bagdad. The Turks made no defense of the city, but fought a delaying action at Diala to permit the evacuation of Bagdad and the withdrawal to Mosul. This retirement was probably made necessary by the difficulty of supply from their distant bases at Anatolia and Constantinople, and the threat of a Russian advance from Bitlis.

A telegram published in *La Nacion* on the 21st inst. has the following on the subject of the German retirement on the Ancre and the Somme. The formidable system of trenches which for two and a half years has remained immovable from the sea to the Swiss frontier, making it appear that a decision by arms was improbable, is about to disappear. This master-stroke of the genius of Hindenburg will surprise both friends and enemies.

Hundreds of thousands of men will soon begin to battle in the open. Never before since the beginning of time has humanity been in the presence of such transcendental hours as are now approaching. The world has grown accustomed to thinking that the will to conquer was only the will to resist. Here during the last few days I have seen the most minute details of a near offensive and I can publish to all the world thru *La Nacion* what they must expect in the near future. In a short time the prospect of peace so greatly desired may gladden the hearts of the neutral peoples. The belligerents themselves, especially the Entente, may begin to think themselves freed of the nightmare of impotence and proclaim to the world that the victory of their arms is approaching.

The German troops are beginning to initiate a great retirement such as was effected in Eastern Prussia in 1914. They are about to repeat the skillful movement of Hindenburg, whose withdrawal made possible the conquest of Poland.

I pray these words may serve as a warning to those whose hearts are anxiously following the heroic attacks being made by the sons of France and England. Events will shortly happen to cloud their premature optimism. I pray also that this may serve as a warning to those who see in this only a phase of resistance to a feeble offensive. Here the Germans, tho it appear a paradox, will advance retiring.

It is easy for me to prophesy, as all that these hundreds of thousands of men have accomplished in months of labor I have seen at close hand. They have confided to me secrets connected with this brilliant operation. At various times I have passed over all this region to the west and south. For six hours by automobile and on foot I have gone over the lines where the new German works were being prepared. The soldiers, like ants, have accomplished marvelous works. Millions of cubic feet of earth have been removed and veritable forests of wire cover extensive fields. The works are not yet finished and the soldiers are still tranquilly engaged in their labors.

These men understand their mission. From more than one I have heard these significant words: "Adelante Hindenburg." Probably the same soldiers will be surprised by the results. Much has been done that to the uninitiated is really incomprehensible. The principles of tactics and regulations which until now have been sacred have been disregarded. For obvious reasons I am not permitted to give details. Doubtless it will be sufficient to give an idea of what is happening to say that soldiers will have to learn anew their duties, as in passing thru these trenches and fields of barbed wire they will encounter many new ideas.

The constructions and technical applications reveal the inventive genius of the great man who dominates the armies of the Central Powers. The shelters of the troops during the battle are so simple and practical that I cannot resist the temptation to compare them to the egg of Columbus.

These new ideas cannot fail to have the gravest consequences to the French people. In brief, some of their towns no longer exist. It is the hard law of war. They have been converted into glacis. They have been at this work for six months and it has been necessary to sacrifice many towns and villages to secure

fields of fire. I have seen villages totally destroyed, others half destroyed. This cannot be called systematic destruction; but, systematic or not, it must be confessed that a great portion of Northern France has been sacrificed to Moloch.

While visiting this town which has suffered so terribly, I talked with a German Officer who accompanied me, who said: "I assert before God that we have not desired this. We want peace. Now approaches the inexorable wheel of Fate. Those who wish war may have it. The battle is on."

I asked this officer what the military authorities expected to gain by the retirement. He replied, "In the first place, they desire to secure the initiative in the campaign this year. At the time when the enemy proposed to reopen the battle of the Somme with redoubled energy the retirement will begin. In this manner the plans of the Allies will be upset in the simplest manner. Their terrible blow will fall upon vacancy. Now they will have to advance millions of tons of ammunition, to bring forward depots and hospitals, and will have to construct new trenches; in a word all the matériel for the supply of the troops on the line during the winter must be suddenly transported. The troops will have to camp in the open and advance over barren fields where their batteries cannot follow.

From this month forward we enter into uncertainties and nobody knows the sinister possibilities of these master works of defense. Weeks and months must pass before the Entente can strike at the powerful system. The Allies will be forced to make tremendous sacrifices.

By shortening her front Germany will release offensive forces that must have a decisive effect on future operations soon to take place. It will besides secure an improvement of the advanced lines. The last line held by the Germans was the result of the battle of the Marne; this line was unfavorable for Germany and unsuited for resisting the pressure put upon it by the Entente forces during the summer and autumn.

The new front, on the contrary, has been carefully selected, taking advantage of all features of the terrain. Moreover, it signifies for Germany an important gain of time. Never has the English proverb, "time is money," had such significance as at present. The Germans have transformed it into "time is victory." The German army which with its allies destroyed Rumania is now free. Other troops have been made available by the shortening of the front. Who can say what this limitless power is capable of doing when thrown on this front? Former deeds of arms cannot be compared to the tempest that will be produced here.

This withdrawal is entirely voluntary. In the course of the war I have seen the German troops frequently advance; but never have I seen them so confident of victory as now when they are retiring. A total transformation of the character of the war is approaching.

Hindenburg and Ludendorf are again seizing the initiative for the German armies, notwithstanding the conference at Petrograd and the concentration of great masses of troops, munitions and other materials on this front.

Many believe that the progress of the Allies is that of conquerors, but in a brief time events will show that the operations and measures are dictated by the same Hindenburg who in 1914 forced the evacuation of Poland by gaining a flank. Coming events will make it difficult to distinguish the most important factor of the Hindenburg decision.

What is this factor? Is it perhaps the obligation imposed upon him by his responsibility to the people? Is it a master-stroke of a man of genius? Is this the simplicity of the new methods of war that I am seeing here?

[A Visit to the Anglo-French Front of Operations. By Severiano M. Anido, Brigadier General. *Mem. de Infantería,* Apr, '17. 2000 words.]

The terribly destructive effects of modern artillery fire together with the highly developed methods of observation and reconnaissance have compelled the troops to seek the protection of the trenches, and have converted the strife on the western front into a war of positions.

There have been many changes in organization and armament, and particularly in the methods of the infantry attack. Camps of instruction are maintained in rear of the lines where new ideas are constantly being tested, and the lessons learned from daily experience are formulated into practical methods.

The tactical unit of the infantry, the battalion, consists of a machine gun company and three other companies organized as follows: Each company is made up of three sections; each section is subdivided into groups of different strength variously armed with hand grenades, automatic rifles, bomb throwers and regulation repeating rifles.

An attack exercise with troops armed as above was carried out as follows: under cover of the fire of artillery and trench mortars, the battalion advanced with two companies in first line and two in support following in columns with wide intervals; upon reaching the pits (shell holes) in front of the enemy trench, a curtain of fire was established by the artillery which kept the enemy down and prevented reinforcements coming forward from the second line. Preparatory to the assault a violent fire was opened by the machine guns, bomb throwers and trench mortars, and the attacking infantry with the grenadiers leading, advanced rapidly from pit to pit and with bayonet in hand finally leaped into the hostile trench for hand-to-hand conflict.

Success in this character of attack requires the most perfect co-operation between the infantry and artillery; this is made possible by the airplanes, which, by the use of wireless keep the commander constantly informed of the various stages of the attack and permit the curtain of fire to be adjusted to the movements of the infantry. Where clouds or other conditions prevent this observation the co-operation is

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secured by the exact timing of the infantry movements, which are subordinated to the action of the artillery.

General Pétain considers this co-operation the most important factor in modern warfare, and the rapid changes in artillery matériel demand constant study and modification of methods to secure this harmony of action.

[The Battle for St. Quentin. By Hilaire Belloc. *Land and Water,* Apr 5, '17. 3500 words. 3 sketches.]

Before the enemy was compelled to his recent retirement, the line which he held thru France formed a gigantic salient, the character and peril of which have been familiar to all for more than two years. It was a line which went from north to south from the North Sea to the Noyon curve, and then went from west to east thru the Argonne to the Meuse near Verdun.

Until his opponents had grown to his own stature in number and munitionment, such a trace gave to the enemy the advantages of the occupancy of enemy soil, the use of a great industrial area, and the shutting off from the French of most of their coal and nearly all their iron.

But from the moment the Allies became the equal in men and fire power, the trace began to involve a great strategic peril, because if a breach is effected on either side of a salient—especially at some way from its apex—the whole salient goes and there is an immense rupture produced in the lines which spells disaster.

As the Allies passed the enemy's capacity in men and fire power on the west, this peril increased. The Battle of the Somme rendered it acute; the continuation of that great action by perpetual local pressure during the winter rendered it, at last, menacing in the highest degree; and after the occupation of Hill 127 above Miraumont, the danger was so overwhelming that a retirement was imposed as a necessity upon the Germans. The only thoro solution was a retirement to the base of the great salient, that is, to a line covering Lille and Maubeuge, striking the Meuse near Mézieres, and so up that river to Verdun. A vast retirement of this sort under pressure of a superior and active enemy would mean tremendous losses in men and material and perhaps final disaster into the bargain, for after such losses it might well prove impossible to take up the new line securely.

The enemy was therefore compelled, against his will, to a doubtful and unsatisfactory compromise, a local straightening of his line which would leave the salient as a whole in being tho with a new and sharp apex near Laon instead of the old rounded one near Noyon.

The plan was to strike a fairly straight line from Arras, covering Cambrai, just covering St. Quentin, its vital central point, and striking the old line above the Aisne east of Soissons and south of Laon. The formation of this new line involved the abandonment of a narrow crescent of country less than thirty miles at its greatest depth, tapering to nothing at either end and averaging some six or seven miles in depth.

The power to hold this new line is the criterion of the enemy's success or failure. That power would be tested by his ability to hold the center at St. Quentin and to keep intact the pivot near Laon. If he loses St. Quentin he loses the line. The battle for St. Quentin, therefore, is almost for the first time in this war a battle in which a well-known town has a true strategic meaning, quite apart from any political importance it may possess.

(The power of the enemy to hold St. Quentin and the pivotal point near Laon is then analyzed. The conclusion is that the enemy is handicapped in holding this line by two things: (a) Miscalculation of the rate of pursuit, and (b) the fact that he can never have intended this line to be permanent.)

[War Notes. By Captain H. M. Johnstone, R.E. (retired). *United Service Magazine,* May, '17. 4690 words.]

Germany's internal condition of privation is such that it would bring her very quickly to the idea of capitulation if the majority opinion were that she could no longer hope to win in the field; but her condition is so bearable, that is, so far removed from starvation, that she can and will endure it as long as she fancies she has a reasonable chance in the field. If the German retreat on both sides of the Ancre was really a voluntary strategic maneuver on their part, it must have had some deliberate purpose. There may have been three purposes in such a retreat: the German command may have wished to create an open space between their own troops and those of General Gough, with the idea of emerging from trench warfare into the freer maneuvering of former days; another object may have been nothing more than the hope of getting a few weeks of peace on this vexed part of the front; and the third hypothesis is that the German Command is collecting a great striking force somewhere else on the western front.

A capture of guns and prisoners of the extent the English have achieved might be looked for from an operation of war in which, free maneuvering being possible, a substantial body of enemy had been turned by a flank and had its retreat cut off. But in the battle of Arras there could have been no such maneuvers and the large captures are due to one or both of two things—the demoralization of opposing units, or the rapidity of the English advance. The last would account partly for the hundred guns, but demoralization must be ascribed as part of the cause at least of a German loss in prisoners equalling in numbers the bayonets of a whole division.

The first inclination of the German command, on hearing of the revolution in Russia, may have been that the time had come for a special attack on her. But the new activity in the west would compel the Germans to think twice before tying up a large proportion of their strategic reserves in the huge Russian field. Germany would probably take the safer method

of trying to promote disagreement between parties in the Russian Provisional Government, by which method more harm could be done to the cause of the Entente than would be caused by German victories in the eastern field.

[The Allies' April Offensive. By H. Bidou. *Land and Water,* May 10, '17. 2100 words.]

It is quite certain that Germany had formed two large masses of reserve, one in France, comprising some 50 divisions, the other between the Rhine and the Danube. The Franco-British offensive compelled the enemy very rapidly to expend an important part of this reserve. On the French front, between Soissons and Rheims, the line was held at the beginning of the action by 13 divisions. The enemy flung 12 new divisions into the furnace, and only at that cost was able to prevent his line from being broken.

The general plan of the battle was as follows: The Germans having denuded the center of their line between Arras and Soissons, the Allies attacked on the two flanks between which the enemy was retiring, the British troops attacking on the Arras front, the French troops attacking to the east of Soissons. It was thus a question of double pressure upon the enemy's flanks: a repetition, with much more powerful means, of the plan of September, 1915. With reference to the efforts of the French, the Germans had 5 main centers of resistance on the 50-mile front which the French attacked on Apr 16 and 17. On the west, the plateau of Condé, which was carried; then moving towards the center, Craonne, which held firm; Ville aux Bois, which was carried; Brimont, which held firm; and last, in the east, Moronvilliers, the capital point which was carried. To these results must be added 20,000 prisoners and much material captured, and 12 German divisions taken from the general reserve and thrown into battle. If the battle did not result in the breaking of the enemy's line, it certainly shook and imperilled it. The efforts of the French attacking on the south are intimately associated with those of the British attacking on the west. The Germans are thus being subjected to a most formidable pressure which will constitute to-morrow's battle and to-morrow's triumph.

[The Mill. By Hilaire Belloc. *Land and Water,* May 10, '17. 3000 words. 2 sketches.]

The steady process of sucking the German reserves into the mill and grinding them down has proceeded this week after a fashion which can be followed more easily than usual, because the alternative days of stroke and counter-attack, and the alternative action of French and English on the left and right of the long line happened to fall on this occasion with great symmetry.

The main English blow fell on May 3 and marked the capture of further positions in that now fractured line upon the extreme north and extreme south of the sector attacked. The enemy counter-attacked and lost very heavily on May 4, 5, 6 and 7. The great French blow was delivered on May 4, exactly 24 hours later than that of the English. It was timed to synchronize with the worst pressure against the English. Counter-attacks in which the enemy lost heavily were also made against the French on May 5 and 6. It must be remembered that the capture or loss of a position in the plain is of subsidiary interest. The real interest at this stage lies in the counter-attack provoked and its expense to the enemy.

The whole operation was of the type which now governs all this work over the 125 miles between Lens, on the north, and Auberive, in Champagne, but especially upon the two flanks of the line. A blow, the power of which is based upon the superiority of artillery, and to some extent of morale in the troops, provokes counter-attacks, lacking which the whole ill-protected line would go. The counter-attacks cannot be avoided by the enemy, and yet are, to his full knowledge, enormously expensive. First, because his concentrations for the purpose of delivering them are at the mercy of the superior Allied air work, and therefore superior Allied artillery; secondly, because in the delivery of them he cannot prepare the same weight of fire that the Allies can, and the troops which he sends to the shock lose enormously just before contact and on contact.

There is nearly always some point where the weight of the counter-attack just manages to tell, and the test of it is loss of ground. But even for such success, the price paid is too high; while along the mass of the line there is mere disproportionate loss without any compensating advantage at all. After each such blow the dwindling reserve must be further drawn upon, and the process continued inexorably (short of political failure) to the military end of disintegration.

[The Hindenburg Line. *Independent,* June 2, '17. 500 words.]

The *Frankfurter Zeitung* says that Hindenburg is conducting defensive war according to a new method, a combination of war of position with war of movement. Systems of deep trenches are most carefully constructed and the defense in the trenches is mobile. The front trenches, exposed to bombardment, are most lightly manned; there is an elastic bending back; infantry attacks are received in skilfully constructed cross-positions; and powerful counter strokes are made at the right time and in the right place.

The British have found the above to be the nature of the tactics employed by the Germans at present. However, the British and French captured 50,000 men and 1500 guns during April and May. It is thought that the 500,000 reserves that Hindenburg had accumulated for an offensive somewhere have already been consumed in this defensive. On the other hand the French are frankly disappointed over the results of their offensive, and there is a popular demand for the removal and punishment of the generals responsible for the failure.

[Von Kluck's Objective After Mons and Charleroi. By Major T. E. Compton. *United Service Magazine,* June, '17. 2000 words with map.]

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In the plans of the General Staff at the beginning of the war, the destruction of the French armies was a consideration of paramount importance. Germany desired to contain Russia beyond her own frontiers, or at least to hold her in check during the period necessary for bringing about in the west a colossal victory, after which the bulk of the German armies could be directed against Petrograd. The intervention of Great Britain was an unpleasant surprise, but this only added another reason rendering desirable a rapid and decisive stroke against the French. At Charleroi the Germans came near to bringing off a considerable coup at the beginning of the war. The whole of the German armies operating to the west were in France, and altho on the extreme eastern flank they were brought to a halt in Lorraine, the five armies which had invaded Belgium were all pushing forward to the west.

The German right was able to advance to the Oise, owing to the numerical weakness of the British Expeditionary Force. Was Von Kluck's objective Paris, or was his subsequent flank march across the northern face of the entrenched camp of Paris merely a part of the German strategical plan? If the French armies had stood to fight on the Somme and thence on a line between the Oise and the Aisne, and so on to Verdun, and had there and then been decisively defeated, Paris would have been Von Kluck's objective; but as there was no battle his objective again became the British army. Up to the 3d of September Von Kluck's march seemed to be directly on Paris, but when the Germans turned eastward and proceeded to march across the northeastern front of the Paris defences, it was assumed that this move denoted a sudden change of plan and an abandonment of the march on Paris. The French armies had been tactically beaten on the Belgian frontier, but their retirement as far as the Marne was purely strategic. Von Moltke had laid it down years before that in a war with France the French army must first be decisively beaten and broken up before marching on Paris, and Clausewitz had before him recommended the same procedure. It was a deception for the troops of the German army to find themselves leaving Paris on the right, but the plan had been decided upon in advance. Maps found on the bodies of German officers confirm this view. Three packets of maps were distributed for the French campaign, and two of these only were issued to those who fought in the battle of the Marne. Of these two packets one was for Belgium and the other for the northeast of France, from the Belgian frontier to the upper Seine and Aube, including the departments of the Somme, Oise, and Aisne, but not including Paris. The third packet contained more country south of the Loire and all of the country south of Paris as far as the river Cher. The inference to be drawn is that operations on the Seine and Aube and probably also on the Loire were intended by the German Staff to precede the investment of Paris. Von Kluck's objective, therefore, was the outer flank of the enemies' line of armies, and when the French army retired to Paris and the British army retreated behind the Marne there was nothing to do but march east and southeast at the heels of the latter army. As evidence of German premeditation in the invasion of Belgium, the fact that the map of Belgium issued to officers is dated 1906 is of interest,

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[The German Campaigns in the West, 1914-1916 (Concluded). By Colonel Feyler, Swiss Army. *Revue Militaire Suisse*, June, '17. 4000 words.]

4. *The Battle of Flanders*

The engagements which began now, from the vicinity of Ypres to the sea, followed logically from the preceding operations, being inspired by the same need. In spite of the talk in Germany about a "march on Calais," the offensive in Flanders was still a counter-offensive, with the same objective of regaining the initiative by enveloping the enemy left flank.

For this purpose a new army was organized, composed partly of rapidly trained volunteers and partly of seasoned veterans chosen from the best troops in other sectors of the front; in all, fourteen army corps and four corps of cavalry.

The first attack was made by the volunteers on the extreme right. The German command took no notice of losses and attacked for six days, pouring in their masses to be swept away by the artillery of the defense, until at last forced to retire by reason of their losses and by the flooding of the region. The Allies then took the offensive and, by Nov 16, had regained a portion of the territory lost by them in the beginning. This ended the battle.

Strategic Commentary

The German General Staff has pretended to consider the maneuver in Flanders an independent operation separated from prior events. However, to a close observer, the battle of Flanders is no less than the fourth phase of one and the same maneuver, the maneuver of enveloping the Allied forces.

The first phase was the maneuver of the Meuse. The Germans had the initiative and threw back the Allies some 180 kilometers in their own territory.

The second phase was the maneuver of the Marne. The Allies took the initiative here and forced the enemy to retreat about 80 kilometers.

The third phase, that of the Aisne and the Somme, was directly linked to and prolonged the preceding phase, the Germans attempting to regain the initiative and the Allies to retain it.

The fourth phase was the Flanders maneuver. The Germans, despairing of regaining the initiative along the Aisne, made their attack some 100 kilometers to the north. They attempted on a larger scale the same thing they had tried on the Aisne when they pushed forward on Noyon a flanking column charged with preventing the enemy envelopment.

We have then:

The operations of the Meuse, a German offensive and a broken Allied offensive.

The operations of the Marne, an Allied offensive and a broken German offensive.

The operations of the Aisne and of Flanders together, an Allied offensive and a German defensive with a counter-offensive.

5. *The Battle of Verdun*

By considering only one event, the event of the beginning of the battle of Verdun, we may understand the rôle which the Germans intended this operation to play in the war and how it links up with the past.

The maneuver of 1914 had been broken up in Flanders. By the extension of the lines from Switzerland to the sea all flanking operations were now excluded. There is, therefore, no direct strategical connection between the battle of Verdun and the campaigns of 1914. The idea of the attack was probably born of the insufficient results obtained by the Austro-German armies in Russia and the Balkans in 1915. The gains of territory realized had not been able to procure that which only the destruction of the enemy forces could procure: a peace imposed on the adversary. But to push on further in the east would have given the Allies further time to strenghen in the west. There remained no solution except to turn again to the west and by a sudden blow to wrest from the Allies the peace desired. By the unexpectedness and the sudden crushing force of a mighty attack, the Germans hoped to stem the French and beat them to their knees.

Verdun was chosen. A particularly strong sector, the risks of the attack would be serious but so much the greater the prestige if successful.

Four specially trained army corps were placed under the orders of the Crown Prince. The Emperor came to show himself to the troops and personally signed the order for the attack. The troops, under cover of powerful artillery, attacked suddenly in masses and on a narrow front of twelve kilometers.

Many reasons have been given for the battle; it has been said that the taking of Verdun would disengage the basin of Briey, and that to prevent the French from taking up an offensive supported by Verdun, the best means was to take the place. This motive may have contributed to the choice of the sector, but the stage management of the assault and its relation to the campaigns from 1914 to 1916 show more than an intention of a local victory and a simple reduction of a salient. The Imperial Government wished and hoped to end the war advantageously at Verdun. To uphold the prestige of the German Empire and the Hohenzollern dynasty, it was necessary to show itself victorious everywhere, in the west, to efface the check met in 1914, as well as in Russia and the Balkans. If the attack had succeeded, in all probability an offer of a "generous peace" would have been made.

6. *The Battle of the Somme*

The battle of the Somme began during the last days of June, 1916. The fighting broke out to the east of the Meuse at Thiaumont and Fleury, while on the west bank bloody assaults were made on Hill 304.

By July 5th the German front line positions had been taken along more than 25 kilometers of front and some 18,000 prisoners had been taken. Since the beginning of the trench warfare, never had such a gain of territory been made so rapidly on such a wide front. Tho the German dispatches affected to ignore it, nevertheless, three divisions were transferred from Verdun to the Somme; the reserves were brought up; battalions were hastily formed by taking companies from everywhere in the vicinity; and the great attack on Verdun came to an end, the French being enabled to take the counter-offensive. From Aug 5th to Dec 16th the Germans were pushed back in the vicinity of Verdun, losing thousands of men and many guns.

Meanwhile the French and English continued their attacks by successive blows on the Somme, the English faced toward Bapaume, the French toward Péronne, and both converging on Combles which was taken at the end of September. From here the English pushed toward Bapaume thru Sailly-Saillisel and the French toward Péronne thru Bouchavesnes. The English combined their advance thru Sailly-Saillisel with another thru Thiepval and the valley of the Ancre, and, finally, one north of the Ancre, thru Puisieux and Achiet in order to reach Bapaume from the north. The French acting against Chaulnes maneuvered against Péronne from the south.

At the end of October the British had passed Bouchavesnes and had moved down toward the Ancre, to the north of Thiepval and Courcelette. By Nov 1, while the French menaced Chaulnes the English, extending their attacks to their left, secured a foothold on the plateau north of the Ancre. In all the Germans lost more than 74,000 prisoners.

The British were in a satisfactory position for a resumption of the drive in the spring and in February, 1917, they pushed forward again. By the end of the month Bapaume was crowded closely from the north, west, and south; the wood of Saint-Pierre-Vaast was occupied and Péronne was menaced with envelopment.

Then the Germans began to retreat. They straightened out their lines falling back to the line thru Arras-St. Quentin-Laon-Soissons. The second purpose of the Somme offensive was realized: it had stopped the German offensive at Verdun; it had forced back the west wing of the German front on the Aisne.

Strategic Commentary

The battle of the Somme was one of the determining causes of the German retreat in 1917. But it was preceded by other causes which it is instructive to recapitulate.

To determine the moment when the question of retreat was virtually imposed on the Germans, it is necessary to go back to the checking of the German offensive in Poland. This check, called by German commentaries a decisive victory, changed the whole plan of war which had aimed at the rapid crushing of France and the subsequent conquest of a Russia abandoned to her own devices. But sufficient time was not allowed the authors of this plan. The French army had not been destroyed; both it and the British army

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were growing stronger; and the Russian army, not having been put hors de combat, another campaign would have been necessary against it to finish the work begun in 1915. However, under the menace of the second battle of Champagne, in the autumn of 1915, it had been necessary to hastily transfer back the troops sent to Galicia in the spring. The Austro-German army, increased by the Bulgarian forces but diminished by the forces opposed to the Italians, was not strong enough to carry on active campaigns simultaneously in the east and west.

If peace were not obtained, a retreat would become imperative on one front or the other.

But how was peace to be obtained? It was not possible except by a blow in the west violent enough to force the Allies to accept German terms. Hence the Verdun offensive, which failing of its end, left only the hope of a peace by compromise instead of a dictated peace.

Even this hope was shattered when the Russians under Brusiloff once again returned to the attack sooner than was expected. The Germans appealed to the Turks for aid and organized an army under Falkenhayn. They ceased the attack on Verdun, organized the resistance to the Somme attack, and took the defensive on all the west front.

* * * * * *

To sum up, a consideration of the six great phases of the war in the West leads to the following conclusions:

In 1914, the German offensive had not succeeded, in spite of the vast German resources and the advantage of interior lines. The Allied armies were left intact and were strengthened and consolidated during 1916 when Germany sought a decision on the east front.

In 1916, the regional offensive at Verdun failed. The French replied with the counter-offensive on the Somme. This ended the attack on Verdun where the French retook their former positions.

The Germans could not accomplish this on the Somme and were forced back.

The peace propositions following the campaign in Rumania, in which the German Staff used the new reserve army formed during the summer of 1916, were the necessary consequence of the inferiority of the German army due to its reverses in the west.

The German Staff in the spring of 1917, did not consider itself able to obtain, with the reserves formed during the winter, the decisive results which it had not been able to secure with the intact army of 1914 or with the specially trained force in 1916. Nor did it consider itself able to remain in place and support losses such as had been inflicted on it in the Somme attack.

The opening of the fourth campaign of the war is characterized, then, by the acknowledgement of enemy superiority on the part of the Imperial Staff; a superiority which prevents Germany from enforcing her will as to the conditions of the war and obliges her to yield her former conquests in order to seek whatever relative advantages she may desire.

[The Battle of Messines Ridge. By E. F. *Sphere*, June 16, '17. 1000 words. Map and panoramic sketch.]

Messines Ridge, 300 feet high, dominated the British positions at Ypres. It was scarcely possible to organize sufficient masses of artillery to make alone the necessary preparations for the capture of the Messines Ridge, so more than a year ago a gigantic scheme of mining was begun, resulting finally in the placing of nineteen mines charged with a total of about 500 tons of explosives.

The preparations for the attack from Ypres were known to the Germans, but they had taken no steps to guard against the greatest peril. The preparatory bombardment was extremely heavy. The guns of one division fired 46,000 heavy and 180,000 field shells. The writer heard this cannonade in the Surrey downs, 130 miles away.

All preparations for the attack were completed on the evening of June 6, and the mines were fired at 3:10 a. m., June 7. The effect was tremendous, but notwithstanding the bombardment and the explosion of the mines, German signal rockets arose from the debris. There were about six German divisions (2d, 3d, 23d, 35th and 40th Bavarian and 24th Saxon) in the defensive lines, but they could make no immediate stand against the British and Australasian rush. Messines was capture about 5 a. m. There was a desperate struggle for Wytschaete, but the Irish divisions captured it before noon. Artillery was brought up and Oostaverne was captured about 4 p. m. The Ypres salient had been flattened out; no counter-attacks were made until the next day, and then only weak ones. Seven thousand prisoners were captured, and undoubtedly many Germans perished in the explosions. The British loss was less than 10,000, of which probably 60 per cent were walking cases.

[Army Notes. The Ancre and After. *Army & Navy Gazette*, June 23, '17. 600 words. Quoted.]

(This article gives a good summary of Sir Douglas Haig's report of operations from Nov 18, 1916, to the end of the first week in April, 1917, and hence is quoted in full.—Ed.)

"A special supplement to the *London Gazette* of the 19th inst. contains a despatch from Field Marshal Sir Douglas Haig, in which he describes the operations of the British Armies in France from Nov 18 of last year up to the end of the first week in April. Sir Douglas was resolved that he would push during the winter the advantages which had accrued to us by reason of our successes on the Somme and the severe losses which the enemy had there suffered, that the German forces should be dispossessed of such points south of the Ancre as they still held, and that in particular we should gain entire command of the spur above Beaumont Hamel. These operations had to be carried out in conjunction with the necessary prepara-

tions for the resumption of a spring offensive, the training of the new troops, and with a large and gradual extension southwards of the British front, which presently occupied a length of 110 miles. As a result of our winter offensive the Beaumont Hamel spur was occupied. Grandcourt was captured, Miraumont and Serre were evacuated by the enemy; Le Barque, Gommecourt and Irles were taken, and before the middle of March the enemy was falling back upon a new defensive system, which for some time past had been under preparation, and which was known as 'the Hindenburg Line.' This, branching off from the original defences near Arras, ran southeast for twelve miles to Quéant, and thence passed west of Cambrai towards St. Quentin; and it was evident that the enemy hoped and intended, if possible, to escape from the Arras—Le Transloy salient and even from the larger one between Arras and the Aisne valley. The British Commander now ordered a general advance in order to hasten this withdrawal, and as a result our troops had within a very few days captured Chaulnes and Bapaume, had entered Roye, and progressed north of Peronne, and their further rapid advance was only checked by the increasing difficulty of maintaining our communications over the country devastated by the retreating enemy. By Apr 2 we had driven the enemy from his advanced positions in front of his main defence, and contact was established all along our front south of Arras with the Hindenburg Line. The despatch covers five months of hard fighting under most trying conditions, but the operations have enabled our commander to gather much of the fruit of the Somme battle; we have reverted to conditions more resembling open fighting than anything seen for two and a half years, and our men have proved themselves the better fighters; the demands made on the transport have been heavy, and the railway construction has been unprecedented, but the solution of the difficulties of our advance has depended upon it; our casualties have been exceptionally light. The general tone of Sir Douglas Haig's despatch is one of confidence, and no one can peruse it without being imbued with the hardy optimism of him who penned it."

[A Visit to the British Front in France. By Victoriano Casajus. *Memorial del Infanteria,* June 19, '17. 1900 words. Continued.]

The increased range of artillery and the ever present airplane have caused the higher commanders to move far from the firing line. Command will extend as far back as 70 kilometers from the firing line. Battalion commanders are the senior officers living in the trenches. Brigade headquarters are usually 3 kilometers back in some village within artillery fire. Headquarters buildings are bombproof. Division headquarters are in a village or town 8 kilometers in rear of the firing live. Army Corps Headquarters are in important railway or communication centers 15 kilometers back, and Field Army Headquarters 70 kilometers back, in some city.

The means of communication used must guarantee laison at every moment between Field Army Headquarters and the captains and majors in the firing line. Between Field Army Headquarters and Army Corps Headquarters telegraph and telephone lines are strung overhead. Between Army Corps and Division Headquarters they are strung on the ground, and between division and smaller headquarters they are well buried. Communication between adjacent headquarters is carried out by the use of automobiles, motorcycles, bicycles, and horsemen.

Radio-telegraphy is used at some headquarters.

Camion trucks for the rapid movement of troops are parked at some headquarters. At all headquarters a map is kept which, by means of small pin flags, shows the daily position of the firing line.

The transport service on all fronts is carried on chiefly by auto trucks. They have solved the supply problem. The English soldiers' daily ration consists of 1¼ lbs. crackers, 1 lb. beef, 4 oz. marmalade, 3 oz. sugar, 2 oz. preserved vegetables, 1/3 oz. tea, ½ oz. coffee, pepper and salt. In addition, 4 oz. bacon, 3 oz. cheese, ⅛ can condensed milk are sometimes issued. Without the auto truck such rations would be impossible.

Repair shops employing some 5000 men and women are located behind the English lines. Everything from a watch to a truck is repaired here. Shoes are repaired, oiled and turned out at the rate of 22,000 per day.

The British supply system is extremely well regulated. Supplies are received by boat twice a week. From there they are sent out once a day to the front by railroad. One month's reserve is kept in the storehouses. Clothing and equipment supply is also especially regulated.

Bread is manufactured at the rate of 310,000 rations per day in one bakery which operates 90 ovens and 800 bakers.

[Occupation of Belgian Coast Positions by the British. *Sphere,* June 30, '17. 250 words. Map.]

British troops have replaced Belgian near the coast. The Belgian sector is about 17 miles long, several miles [about 5—Ed.] of which is covered by the inundations of the Yser, created in 1915. The first official intimation of an interchange of troops came in Sir Douglas Haig's report of June 21, in which he stated that we (British) had repulsed a German trench raid near Lombaertzyde. The line runs from Lombaertzyde near the coast southeast to Dixmude, thence southwest to near Noordschate and thence east of south to near Ypres. The line as a whole trends slightly east of south.

[The Great Dune. By Hilaire Belloc. *Land and Water,* July 19, '17. 1000 words. 1 sketch.]

This is an account of an action fought on July 10 on the extreme left of the British line at the place where the canalized Yser falls into the sea. This locality was held by two British battalions.

After an intensive bombardment lasting for several hours the German marines attacked. The defense was able to maintain the fight for about an hour, in spite

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of the complete destruction of defenses and machine guns which had been effected by the enemy's fire. The advance of the Germans along the coast permitted of an enfilading fire which completed their success. But few of the two battalions holding this restricted bridgehead returned. The Germans occupied the mass of sand hills known as the "Great Dune" and now hold ground as far west as the Canal itself on a front of about 1600 yards extending from the sea to the southwards.

Farther south the enemy met with no permanent success but was pushed back from what he had gained.

[The Action Near Craonne. By Hilaire Belloc. *Land and Water*, July 26, '17. 300 words. 2 sketches.]

Since the enemy was driven from Craonne Ridge on May 4th he has launched something like 40 great attacks on this particular sector at a cost of perhaps 100,000 men. What has been his object in this? Probably it is that of attacking the most exhausted of various enemies. These continued and very expensive attacks are undoubtedly combined with a clumsy misunderstanding of the French temper at this moment.

Apart from the political object there is a clear strategic object. The German line between the North Sea and Lorraine is in the form of a set square. If either limb goes there is disaster. The greatest danger is to the northern limb. But if the southern limb broke or fluctuated it would be impossible to hold the northern limb. The enemy is active upon this southern limb because, being inferior numerically and in guns as well as in morale, he must keep attacking, cost what it may, in order to hold at all. The particular objective of the present attack is the Plateau of Craonne which is the extremity of the Aisne Ridge and gives observation over all the northern Champagne plain.

The preliminary bombardment extended for over a week. At 7 a. m. on July 19th the bombardment lifted and the infantry were launched to the assault.

The infantry which took the brunt of the fighting was specially chosen. It consisted of the 5th guard division with whom were distributed elements of "storming troops." The attack failed completely against the western and eastern wings. In the center the Germans obtained a footing in a little over a hundred yards of the demolished front trench from which they were driven during the afternoon. On July 22d the Germans got into the French front trenches on the northern edge of the Californie Plateau.

The enemy has now concentrated against this 2½ miles of line, three, and possibly four divisions and a great mass of artillery. From the last reports the French observation posts on the northern edge of the Californie Plateau were in enemy possession on July 23d, but not the parts on the east overlooking the plain.

[The Battles of August, 1914, in Lorraine and the Ardennes. By Major T. E. Compton. *Jour. Royal United Service Institution*, Aug, '17. 8000 words. 2 sketch maps.]

The glamour of the great victory on the Marne, and the thrilling episodes of the retreat from Mons, had the natural effect of focussing public attention on the operations of the armies in the north-east of France, and hardly anything was known of the great battles in Lorraine which had so much influence on Joffre's strategical retirement and culminating victory. The armies of Lorraine and Alsace held off the German troops which would otherwise have turned the left flank of the retreating French line.

The victories of the Trouée de Charmes, and of the Grand Couronné of Nancy, rendered possible the orderly assembly of the retreating armies in a line, the flanks of which were protected by Verdun and Paris. The rear was then safe and reinforcements were actually drawn from the army of Lorraine.

As the French intended to observe strictly the neutrality of Belgium, their deployment was carried out on the line of the eastern frontier from Belfort to Longwy. These dispositions were well on the road to completion when the violation of Belgian neutrality by Germany became known, thus necessitating an almost entire change. Lorraine and Alsace became at once a theater of comparatively secondary importance, and three army corps were taken away to reinforce the armies of the north. The armies which were left on this front were to threaten the German communications on the Rhine in order to retain the largest possible force of the enemy on this side. The Germans were pushed back to the line Morville-Morthel-Marhange-Rodalben-Bensdorf-Féuétcange, and Phalsbourg. This was the beginning of the Battle of the Sarre for General Dubail; the Battle of the Seille for General de Castelnau.

General Dubail had to keep his forces well in hand and concentrated as the right of the French advance was open to an attack from Saverne and Strassburg. The First Army pushed forward until it occupied a strong line on the Canal de la Marne au Rhin. A large proportion of its troops were still held in reserve, and it should have been at least capable of holding its positions on the following day, had not events on the Seille necessitated a general retirement.

The right of General de Castelnau's army was covered, and on Aug 19 was deployed on the line of the Seille. The French were forced to advance by rushes over ground which had been carefully oriented by the German artillery. At nightfall the line of the Second Army ran from Bisping thru Vergaville, Couthill, to Delme and Nomeny. The next day, however, the Second Army found itself confronted by superior numbers and barely frustrated an attempt to turn its left flank.

This sudden change was brought about not so much by numbers as by greatly superior machine gun and howitzer fire. The six days' continuous marching and fighting had exhausted the troops of the Second Army,

and a general retirement to the line Falloncourt-Marsal-Maizières was necessitated. The Grand Couronné of Nancy formed a secure pivot for the retirement of the French armies from German Lorraine to positions behind the Meurthe.

On Aug 23 the German armies were directing their march towards the Trouée de Charmes, between Toul and Epinal. On the 24th, while the army of Prince Rupprecht was attacking in force the French positions between the Mostagne and the Moselle, General de Castelnau struck at his enemy's communications. The XX Corps and all the troops that could be spared from the Grand Couronné, also the 70th Reserve Division and part of the IX Corps, on the right of the Meurthe facing east, had orders to attack toward Luneville, the right flank of Prince Rupprecht's army. The 70th Reserve Division pushed forward to within two and one-half miles of Serres, but could not make further progress, as the Germans had sent troops here from elsewhere. The French were then able to assume the offensive on the Mostagne. By evening the enemy everywhere was retreating, and on the next day all the villages at the foot of the Grand Couronné were re-occupied by the French.

The Germans were defeated but not routed, and their machine guns and system of entrenchments made progress in pursuit very slow thruout August, and it was not till after the Battle of the Marne that French Lorraine was cleared of the enemy. Nevertheless, the victory was decisive in that it frustrated the German plan of penetration and encirclement on the French right.

At the same time the Battle of the Ardennes was being fought in the north. The French had planned to attack the German force while it was separated by the River Meuse and thus defeat it in detail. Under these circumstances, and in view of the information received at the French headquarters, the offensive undertaken by the Third and Fourth armies had reasonable hopes of success, altho the terrain was in many places a difficult one.

The whole front was about fifty miles. It was intended by a rapid advance to bring the enemy to battle before he had time to entrench. The French hoped for a surprise and, in case of victory, the communications of the German northern force would be menaced, and a route would be opened towards Germany.

However, the Germans were not unprepared for the French offensive and, instead of seven, they had thirteen army corps and three cavalry divisions in Luxembourg and the Belgian Ardennes. In addition to this, the superiority of the Germans in heavy guns, airplanes for artillery reconnaissance, and machine guns was very marked, and infantry training with regard to trench work and field engineering was all in favor of the Germans.

On both flanks of the line the French were successful; but they were greatly outnumbered in the center, and the entire line was forced to withdraw. Inferiority of numbers was, therefore, the main cause of the failure of the French offensive plan, generally. From Mons to Longwy the Germans had twenty-three corps to the French and British eighteen. In the battle of the Ardennes, however, the Germans had very little superiority in the forces actually engaged.

Reasons for the German tactical success included a trained readiness in using entrenching tools. It is also stated that touch was lost between corps, divisions, or brigades in some instances. This was due to the extremely wooded and difficult nature of the country over which the French advanced. As a result, the flanks of units became exposed and open to attack by the enemy.

The Germans had the benefit of superior preparation, superior artillery armament, supplemented by their great proportion of machine guns, and their apparently inexhaustible supply of ammunition.

[Military Events of the Week. By Hilaire Belloc. *Land and Water*, Aug 2, '17. 2000 words. 2 sketches.]

Two points may be considered that have held the interest of the public during the present week. These are: the German actions for the recapture of Aisne Ridge, and the deplorable situation upon the Eastern front. The results of the former are summed up in the French official message of July 28, which stated that three of the five German divisions engaged in the preceding ten days must be replaced; that in the last attacks every man, including cooks and orderlies, was thrown in, and that the last assault, which established itself near the ruins of Ailles and held part of the French front trenches, but failed to reach the summit, was the forty-fourth delivered against the Chemin des Dames since its capture by the French three months ago.

Referring to the Russian situation, the success achieved by the Seventh and Eighth Armies in effecting their retirement without being cut off, after the break down of all discipline in the Eleventh Army, indicates that the enemy had not the power to reap the full harvest promised by the extraordinarily favorable situation presented to him.

The failure of the Galician center in front of Tarnopol would never have occurred had it not been for the abnormal condition of the Eleventh Russian Army and particularly, as it would seem, of the Guards in this same critical point.

[The War on Land. By a Military Officer. *Army & Navy Gazette*, Aug 11, '17. 1800 words.]

A new deliberation is manifest in the recent British attacks. The troops are rigidly restricted in the extent of the advance, and the limit is fixed by the arrangements for thoro artillery protection. As the first wave of the infantry goes over the top some of the guns go forward to new positions while others keep up the barrage and counter-battery work. When objectives are reached, consolidation begins, for offensive returns by the Germans are a certainty, and with little or no delay at important points.

The Germans have tried various methods of defense since the Allies have had the initiative. Formerly they depended upon weight of numbers, but they can no longer afford the consequent losses. Later they

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manned the front line heavily in defense, but a profusion of artillery and shells has made that method too costly.

The latest method is quite different. The front line, often two trenches at a shallow interval in depth, is lightly held under bombardment. The space between this and the next line is held by concealed and heavily protected machine gun posts. Troops for counter attacks are concealed in the line behind. The idea is that the rushing of the front line and subsequent encounter with the machine-gun posts will disorganize the attack and give the counter attack its chance. But the tanks spoil this plan. Bad visibility conditions gave the German defense scheme its best chance, and it failed.

[Haig's Great Triumph. *Military Gazette,* Sept 11, '17. 375 words.]

Sir Douglas Haig has evolved out of his experience on the West front the principle of the limited objective—siege warfare on scientific lines with artillery, aircraft, and infantry acting in perfect combination. The purpose is to wipe out utterly one strongly fortified zone after another. It necessitates long, careful, and elaborate preparation, but each offensive makes a breach in the German wall of men, metal, and material; greater losses are inflicted on the defenders than on the attacking force, their morale is damaged, and the way is prepared for the next shattering blow. The fixing of a limit to the objective, and the employment of guns that obliterate almost everything within range, save the lives of many men. The British losses in recent battles are far below the number anticipated. On the other hand, the Germans lose heavily in their futile counter attacks.

[The Battle of the Menin Road. By Hilaire Belloc. *Land and Water,* Sept 27, '17. 2100 words. 3 sketches.]

The Passchendaele Ridge position is a long crescent reposing upon two pillars, as it were, which are the northern and southern ends of it. The northern pillar is the large forest of Houthulst, which is perfectly secure area and cannot be cleared by direct attack. The southern pillar on the Menin-Ypres Road in front of Gheluvelt, tho very strong, is more vulnerable and has therefore been the main objective of the Allies in their recent six weeks of preparation. This point was captured by the British on Sept 20. The Germans counter-attacked strongly during the late afternoon of this day and on Sept 21. The failure of the many rapid and well-nourished counter-attacks was largely due to the superiority of the British in aircraft. The massing of troops was stopped, they were bombed from the air while in column and were already shaken before they came under the field artillery and rifle fire of their opponents. According to the accounts afforded, not one of the counter-attacks on the eight miles of front achieved its object. This action offers proof that the last tactical device adopted by the defensive has been mastered. Isolated concrete armaments of machine gun positions, called by the British "pill boxes" have gone down before new methods designed against them. The methods used may not be given but, it is clear that they have proved once more the universal truth running thru all warfare, that the mere defensive, however ingenious or novel, is a prelude to defeat.

The defensive art without any prospect of comparative accession of force, political or military, is the acknowledgment of defeat. *That statement is absolute in all military history, admitting of no qualifications whatsoever.*

In the present circumstances the prolongation of the German defensive does not aim at a comparative accession of force. The Allied force has far more in reserve than the Central Empires. The German defensive is clearly based upon some hope that political aid will come when military aid is no longer available. It is based upon the gamble that if the defense of the besieged is sufficiently prolonged, the determination of the besiegers to win will fail: that the political structure behind the Allied armies will break down either by a quarrel between their component governing powers, or by the domestic and internal disintegration of their social forces. That is the chief danger before the Allies. On the military side the problem is already solved.

[Haig's Third Blow. By Hilaire Belloc. *Land and Water,* Oct 11, '17. 2100 words. 1 sketch.]

On Oct 4 Sir Douglas Haig delivered the third of those successful blows, each with its strictly limited objectives, which are at once mastering the Passchendaele Ridges and wearing down the German forces opposed to them. When British forces succeed in capturing the entire ridge with its eastern slopes the strong defensive position which the enemy has ultimately depended upon the whole of this Autumn will have gone. To what kind of retirement the enemy may later be compelled is a matter of conjecture, save to those who have the advantage of seeing the photographs taken by aircraft behind the enemy's lines.

If the salient in Flanders be much further advanced the positions of Lille and Ostend become difficult. The power of the modern defensive is so great, however, that extraordinary positions can be held. For this reason one should not build too many hopes upon a mere geographical consideration of this sort. What is perhaps of more importance is the very serious loss inflicted upon the enemy by this action. The enemy was caught by the British advance in the act of preparing a great counter-attack and the surprise was almost complete. About 4500 prisoners were taken by the British.

EASTERN THEATER

See also

EUROPEAN WAR—TOPOGRAPHY OF—EASTERN THEATER

PRZEMYSL—FIRST SIEGE OF

[The Battles of Wlozawek, Lodz, and Lowicz, Nov and Dec, 1914. *La Guerra y su Preparación,* Madrid, Aug, '16. 2500 words. Illustrations.]

The Russian attack, begun the first part of November, was prepared long in advance, and forty army corps and many cavalry divisions participated. The entire Russian force consisted of 2½ million men. Grand Duke Nicolas' plan was that the Army of the Niemen, advancing in eastern Prussia, should drive westward the scattered German forces guarding that region. On his south wing there was an independent army whose duty it was to blockade Przemysl, and to extend to the left along the Carpathians in order to turn the right flank of the Austrian Army east of Cracow. While one army should march on Cracow, another was to advance down the Dunajek and northward up the Vistula.

The principal Russian forces constituted a strong center charged with penetrating western Poland and taking the general direction of Posen and Breslau after routing the German and Austrian forces. Even in Paris and London it was believed that these efforts of the center would be decisive. The Russian forces in western Poland were divided into three groups, the central and most important group extending westerly from Lodz to Noworadomsk.

These plans were known to Hindenburg who realized that the Russians, numerically his superior, must not be allowed to take the initiative. He, therefore, decided to take advantage of his own superior rapidity of movement and to attack. His central forces were divided into three parts. The right wing (Austrian and German troops) was in western Galicia. It was to protect the flank and could not advance until the center was in motion. The central group, covered on its front and right by large forces of cavalry, extended between Kreuzburg and Kolo. The right group (Ninth Army) commanded by Mackensen, was to break the Gnesen-Thorn line, advance up the Vistula driving back any Russian forces it might meet, and, turning to the south, was to attack the Russian right, enveloping it from the north.

The Russians began the attack the first part of November, the Germans retiring to their fortifications in east Prussia before which the Russian attacks failed. Nov 7 the German cavalry in Konin, on the Wartha, decisively defeated the Russian cavalry and drove it back on Kutno. Near Wlozlawek on Nov 13, the Germans turned the Russian right flank, forcing them to abandon Gostynin and Kutno and to retire on Lowicz, suffering 30,000 casualties. Mackensen's army was successful in preventing the arrival of reinforcements to be used against the left wing. The Russian attack in the center failed and they retired to Lodz from where they were finally driven to a fortified position on the Vistula. On Dec 17 they also gave up Lowicz, retiring to a position east of Skierniewice. This resulted in forming an entirely new Russian line extending from the Bzura to the Nida.

In these battles the Russians lost 300,000 men, the Germans taking 130,000 prisoners, and the advance undertaken in such high hopes had failed completely. The commander in chief placed the blame on his subordinates; and they, on him. Great dissatisfaction was felt thruout Russia and the army, and this feeling was felt even in France and England.

[On War Fields. By D. Balanin. *Voenny Sbornik*, Jan, '17. 8000 words. 1 map.]

(After considering the political situation, which contains nothing unknown to our readers, the author describes the operations of the Russian 18th Infantry Division at the outbreak of the present European war. This division had its garrison stations at Ivangorod and Lublin, and commenced its mobilization towards the end of July, 1914, the exact date, which would be of considerable interest, not being given. The author was the commander of the division, and his account of what occurred is entitled to corresponding credit.—Ed.)

The first period of the mobilization was taken up by discussions with regimental commanders as to probable lines of action, and in placing all equipment in the best possible order. The front of the division, towards the Galician frontier was covered by the 9th Caucasian cavalry. The mobilization of the division appears to have been completed by the 15th of August, at which time the division (less the 72d Infantry, and two batteries of artillery), was at or near Lublin. The main organizations present with the division were the 69th, 70th and 71st Infantry regiments, and the 18th Artillery (less two batteries). The troops indicated as absent had been detached by the corps commander, for service elsewhere. The troops present amounted then to 12 battalions, and 32 guns.

On Aug 15, about noon, the commander of the division was directed from corps headquarters to move forward towards the southwest at once, and in compliance with this order, the division marched out the same date. The advance guard, consisting of the 71st Infantry, and the 6th Battery (18th Artillery) reached Vilkolas, 15 miles distant. Information was here received from the cavalry at Krasnik, 10 miles from Vilkolas, that they were seriously threatened by superior hostile (Austrian) forces.

In view of this information, the commander of the 18th Division, on his own initiative, ordered the advance guard on Aug 16 to Krasnik, to secure that town. This operation was carried out without opposition of consequence, but was disapproved of by the corps commander, who ordered the troops withdrawn to a line thru Vilkolas. This was accordingly done on the following date, the Austrians following up the retreating Russians, having learned of the Russian dispositions from air reconnoissances.

But the Russian higher command, having in turn disapproved of the dispositions made by their subordinate, ordered Krasnik reoccupied, and in obedience to this order the 18th Division, first leaving two battalions of the 69th Infantry, and one battery in reserve to remain at a point about 5 miles from Krasnik, turned around and marched to the attack of that town. Krasnik was found to be occupied by Austrian infantry with two machine guns in the town itself, and other Austrian forces on hills about the town. Notwithstanding strenuous resistance, and serious losses, the 71st Infantry attacked and carried the town, darkness putting a stop to the fighting. The commander of the 18th

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Division being still in doubt as to the exact situation, called up corps headquarters on the telephone and requested that he be reinforced by an additional regiment of infantry.

The losses of the 71st Infantry in this attack were 7 officers and 719 men, killed and wounded, being 18 per cent of the strength of the regiment. Of the Austrians 8 officers and 603 men were taken prisoners, besides over 500 killed and wounded abandoned on the field.

The next day, Aug 18th, was quiet. No fighting occurred, and advantage was taken of this fact to withdraw the 71st Infantry to Vilkolas for reorganization, the 70th Infantry replacing it at Krasnik.

In these preliminary operations, the indecision or lack of agreement among the higher Russian commanders should be noted as a prolific source of future trouble.

The corps to which the 18th Division belonged, the 14th Army Corps, under the mobilization scheme, was intended to consist of the 18th Division, two rifle brigades and two cavalry divisions, but at the last moment this arrangement was changed so that at the time this account treats of, it contained only 20 battalions of infantry (three regiments of the 18th Division, and two rifle regiments), with corresponding units of artillery and of cavalry. The 45th Division of the 16th Corps was immediately on the left of the 14th Corps.

Notwithstanding its weakened composition, the 14th Corps was now given an offensive rôle. The intention for the 23d instant was that the 18th Division should attack southwestward from Krasnik, the 70th Infantry along the direct road, the 69th Infantry moving in a parallel column five miles to the west, with a view to enveloping the enemy's left. To connect the two columns one battalion of the 71st Infantry moved midway between them, leaving three battalions of the 71st as the division reserve. The rifle brigade was to attack at the same time in another parallel column some two miles to the west of the 69th Infantry. This made the front of the corps of 20 battalions some seven miles. Against these forces it subsequently appeared that the Austro-Hungarians had three infantry divisions containing 43 battalions.

The movement started early in the morning, and the fighting was soon serious thruout the entire front. The right column, the 69th Infantry, was soon brought to a halt by superior resistance, and this unforeseen contingency reacted on the left column, which had counted on the right column enveloping the enemy's flank. This left column had only one light battery, and one battalion of howitzers to support its attack upon what was found to be an entrenched position. Nevertheless two-thirds of the reserve which was in rear of the left column was sent over to the right to assist the 69th Infantry.

The fighting of the western column increased in intensity, and the division commander personally moved his headquarters to its vicinity. But a little while later the situation appeared still more doubtful of success when strong hostile artillery and rifle fire began from a wood on the right of the western column. The division commander now realized that his front was too great for the size of his command, but it was now too late to correct this fault. The corps cavalry had reconnoitered the wood from which the new army attack came, but had itself started a useless and unsuccessful attack on the superior hostile force of all arms, and in doing so had apparently failed to notify its own command of the situation in this part of the field.

The enemy soon advanced from the wood on the west towards the right and rear of the western column, and the division commander now ordered his last reserves to meet this movement. Just about this time, division headquarters observed clearly thru field glasses, that new and strong hostile forces were moving out in dense masses against the front and left of the left column. Altho this new attack was plainly visible to the Russian artillery, which at once took these enemy columns under their fire, the enemy replied with strong artillery fire of his own, and it could be easily seen that upon one of the Russian batteries this fire was producing heavy losses.

Notwithstanding obstinate resistance against the Austrian advance, these latter continued to gain ground. Nothing had been seen in the 18th Division as to the attack of the rifle brigade, nor had any information been received from any source as to their movements. Only an occasional sound of firing towards the west had been heard. Under the circumstances the division commander considered it hopeless to continue the combat, and at 8 p. m. division headquarters gave the order to withdraw.

The enemy's attack on the right had at this hour reached a point only some 2200 yards from the right rear of division headquarters, and the division commander now personally directed a change of position of two artillery batteries nearest him towards this hostile advance. Thanks to the fire of this artillery force, which was all that there was to oppose the enemy, and to the approaching darkness, the enemy's attack was halted, and the right column succeeded without special difficulty in disengaging itself from the action.

The troops became considerably scattered during the retreat from the battlefield. Division headquarters made good its withdrawal to a small village, some four miles west of Krasnik. Here information was received that the center column had fought all day, had lost severely, but had withdrawn in good order when the rest of the command was observed to be doing the same. The right column reached another village some four miles from division headquarters and quite close to the enemy's lines. As darkness set in a heavy hail storm also came up, and this of course naturally assisted in preventing cohesion among the retiring troops.

All communication lines to higher commanders were found to be interrupted, as well as all local telephone lines. The division commander therefore sent a report to corps headquarters by messenger, but never received a reply or instructions of any kind during the entire night. It subsequently appeared that of the two

mounted messengers sent to corps headquarters, one had been killed and the other had had his horse wounded, and was apparently prevented from delivering his message.

The following morning was foggy, and the enemy showed no sign of any vigorous action. The 18th Division was thereupon reunited without opposition in and about Krasnik.

[Two criticisms appear to be justified by the Russian account. One of these is the apparent lack of reconnaissance, leading to an initial over extension, and direction of what was intended to be an enveloping attack against what was really a portion of the enemy's front. What was intended to be an enveloping attack was itself enveloped and driven back by an unexpected attack upon its own rear and flank. The other criticism is the lack of co-ordination and of connection between the various Russian columns, each looking after its part of the general plan without regard to the movements of its neighbors. In this regard the division commander seems to have depended largely upon personal observation for keeping himself informed as to occurrences on a widely extended battle front, with very indifferent success.—Ed.]

[The Altered Grouping of General Brussilov's Armies. *Sphere,* Jan 20, '17. Two diagrams and note. 100 words.]

(The two diagrams show the grouping of Gen. Brussilov's armies before and after the German invasion of Rumania. The first grouping shows in order from right to left 3d Army (Lesch), 8th Army (Kaledin), 11th Army (Sakharov), 7th Army (Cherbachev), 9th Army (Lechitski). The left then rested in Bukowina. The later grouping shows a general extension to the left. The 3d Army (Lesch) remained as before, north of the Galician frontier. The armies remained in the same order with front extended so that the 9th Army (Lechitski) is on the Transylvania frontier. A new army under Sakharov is east of Galatz. It is not known who commands the 11th Army, formerly commanded by Gen. Sakharov. The gap between the 9th Army and Gen. Sakharov's army is held by the Rumanian 2d Army with Russian supports.)

[In the Field. By D. Balanin. *Voenny Sbornik,* Feb, '17. 7000 words.]

(Continuation of a previous article by same author.)

On Aug 24, after getting oriented, it was found that the division was much scattered over a considerable distance extending both east and west of Prasnik. The author (who was in command) gave necessary orders to concentrate the division covering Prasnik on a front more suitable to its strength. Learning about this time that the headquarters of the XIV Corps was not far distant to the northwest, the author went by automobile to report his dispositions and to arrange for mutual support. Here he learned that the entire headquarters of the 18th Infantry Division had been taken prisoner by the enemy; and at Corps headquarters much confusion was also noticed. Continuing a reconnaissance already started, the author now found evidences of approaching panic in soldiers fleeing towards the rear, and a very considerable panic in the artillery park. These were, however, quelled with the assistance of staff officers present.

On Aug 25, orders were issued for the retreat of the Russian forces. The 18th Division was directed to fall back on two roads assigned to a line thru Xodel and Dusha, about 20 miles southwest of Lublin. The 45th Infantry Division was detailed as rear guard and directed to oppose stubbornly any hostile advance from a position on the heights near Vilkolas, about seven miles in front of the main position. The retreat initiated by the 18th Division soon developed considerable disorder, wagons and carriages of all kinds in lines three deep crowding the available roads. Hostile cavalry with horse artillery also appeared on the right (western) flank, and altho the fire does not appear to have caused any damage of consequence, it was a source of annoyance and trouble. But by the very energetic actions of the division commander in person, assisted by his staff, order was gradually reestablished, and the retreat carried out.

Aug 26 was spent in preparations to defend the position selected, now reached by the troops. It was decided by the higher command to make a determined resistance to any further advance of the enemy, in order to prevent the fall into their hands of the town of Lublin, an important political, commercial, and railroad center. The line was held by three corps; in order from right to left—XVIII, XVI and XIV (the author's).

Aug 27 the Austrians attacked the 14th Corps, attempting to envelop their right. The infantry attack was made by two infantry brigades on what appears (from the map accompanying this article) to have been a front of about three miles. Altho the attack lasted all day, it failed. The Russian losses were considerable, and at the end of the day they felt their position to be somewhat insecure. On this night, 27th-28th, General Evert assumed command of the Russian army, succeeding General Salitsa.

Early in the morning of the 28th, the commander of the 18th (left) Division ordered an advance. This was a serious matter, as this division had its left flank in the air, to offset which the 162d Infantry had been sent out to effect a connection with the nearest troops to the east. Nevertheless the attack was attempted but was late in starting. It immediately encountered an Austrian attack, and a very severe combat lasted on this part of the field for the entire day.

The Russian infantry was well supported in this fighting by the very effective action of their field artillery. Two batteries changed position during the engagement, in order to move towards the flank, from where an enfilading fire could be brought to bear upon the advancing hostile infantry. The howitzer battalion also helped most materially in checking the enemy's attack.

Towards the Russian right and center minor advances were made on this day, but without material result other than to engage the hostile forces in their front. On the whole the net results of a very heavy

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day's engagement appears to have been negative for both sides, neither side securing any advantage of importance. The attack of the 18th Division failed to accomplish its mission, but it made some advance, as did also to a minor extent some other Russian units in other parts of the field. On the Austrian side, altho their attack also failed, they had succeeded in stopping the Russian advance, with but slight changes in their position.

(The losses occurring on this date are not given by the author except for one regiment, the 71st Infantry, which in a foot note is stated as having had the severest losses of any organization, 21 officers and 700 men.)

On the following day, the 29th, the Austrians again attacked, this time attempting to envelop the Russian left. The attack at first gained considerable ground, due apparently to a very wide encircling movement. The opposing sides came into contact at about 7 a. m. and at once opened a heavy fire. Reserves were hastened to the threatened Russian left. When towards midday the Russians received directions from the commander of all the Russian armies that in view of the success of other Russian forces southwest of Lublin, he directed an immediate advance of the forces defending Lublin, the Russians at once passed to the offensive, and again with the very effective assistance of their howitzer battalion stopped the Austrian advance. Darkness put an end to the fighting.

On the 30th a heavy cannonade was started at 6 a. m., but the Austrians attempted no offensive movements on this date, and the Russians also made no advance; a portion of the day being in fact devoted to preparing the position held for defense. The author does not state why the orders of the previous day as to advancing were not continued for the day following.

On this day appears to have commenced the first serious attempt in two weeks to evacuate the wounded. During this period of time the total casualties in a three-regiment division were 49 officers and 1922 men, being 23 per cent of the officers and 13 per cent of the men engaged. In the 2d Rifle Brigade, the killed amounted to 53 officers and 2557 men.

Nothing occurred of importance on the two succeeding days. The Russians wondered why their enemy made no attack, but they did not themselves feel strong enough to move forward, and instead continued to improve the position they held. But on Sept 4 orders were received to pass to the offensive on the next day, the objective of the command being to seize and hold the high ground near Radlin, some five miles to the right front.

At 6 a. m. Sept 6 the fighting was started by the Russian artillery. The Russian infantry appears to have attacked with one regiment of a brigade in the attacking line, and the remaining regiment in reserve. Fronts of attack are not given. Connection between brigades is reported to have been difficult and unsatisfactory. The attack is not described, but it appears to have been on the whole unsuccessful; the objective sought not having been reached in any place. The principal success was obtained on the left of the Russian attack, where by reason of a wood covering the Austrian front, considerable ground was gained, presumably not having been seriously disputed.

At 4:30 a. m. Sept 7, orders were received to continue the attack that day. This order does not seem to have been well received, the local commanders apparently judging that the losses and exertions of the preceding days had about exhausted the fighting abilities of their troops. The division (three regiments only) had so far in the campaign lost 83 officers and 4148 men; and on the 7th instant had only 5190 bayonets present for duty. As a result, on this date there was apparently no real attack, altho a severe fire fight occurred.

On Sept 8 the order to advance was renewed, and seems to have been carried out, altho with serious misgivings on account of the known weakness of the Russian forces and the supposed great strength of the enemy's lines. Nevertheless considerable progress was made, and some 700 prisoners were brought in.

On Sept 9 an attack was again ordered by higher authority, and was carried out as directed, with apparently indifferent success, the enemy's trenches being reported as unusually strong. The Russians on this day lost 7 officers and 250 men. Here the author closes his account without comment and without stating what the final outcome of the campaign was.

[The Maneuver of Vilna-Molodiechno. By Bieschi. Translated and reduced from the Library of the *Biechernoie Bremia*. By Maj. D. Enrique Uzquiano. *La Guerra y Su Preparación*, March, '17. 2900 words. Map.]

The maneuver of Vilna-Molodiechno which took place in August and September, 1915, was the most important example in the present war of operations involving the handling of large masses in modern combat.

The initiative of this movement was taken by the Germans, who, by the end of August, had established themselves on the line Vilkomir-Prusani-Kobrin, and who judged the circumstances propitious to develop a new offensive. The German plans contemplated a sudden attack on the right flank of the Russian west front (south of Dvinsk), thereby obliging the Russian army to retire across the narrow space between Molodiechno and the swamps of Poliesia, a great part of which was rendered impassable by the swamps of the quadrilateral Nicolayevo-Bisnev-Persai-Mur.

The Russian front was at this time on the line Sviensiani-Mosti-Selva-Rusani-Chernol. The vicinity of Sviensiani was occupied by cavalry. The Germans concentrated considerable forces all along the line, and formed a menacing mass near Vilkomir, which advanced slowly. The Germans then attacked the Russians west of Vilna, and simultaneously at Dvinsk. The constant pressure caused the breaking of the line, so that the troops north of Vilna refused their right flank, while those near Vilkomir withdrew to the northeast. German cavalry entered the gap, and penetrated as far

as Molodiechno. The Russian army was not yet hemmed in, but the space available for retirement, if necessary, was reduced, and the German cavalry threatened further reduction.

The Russians met the situation by striking a blow at the German enveloping forces, while fighting obstinate rearguard actions at other points of the line. The forces for the offensive were taken from different points of the line, moved behind the front, and concentrated near Vileica. Some of the troops had to march 200 versts on foot. The dispositions were as follows: 1st, all the forces which could be concentrated at Vilna were moved to that point to dispute the passage of the Vilia; 2nd, concentration was continued for the purpose of attacking the enemy on the front Vileica-Smorgon; 3rd, one corps was concentrated at Polotsh; the remainder of the army of the west front was established on the line Miljailski-Novogrudok-Baranovich-Buigonovichi; 5th, the left flank of the north front assisted in the maneuver.

This disposition was decided on on Sept 9 (Russian calendar) and was practically in effect on the 10th. Since the German project now seemed likely to fail, the Germans fixed their attention on the forces north of Osmiani, which they attacked energetically. By this time, however, the Russian maneuver began to bear fruit, and the Russians gradually forced back the Germans near Vileica.

It still remained for the Russians to reunite their divided forces. For this purpose more forces were taken from the west front to reinforce the troops near Vileica, and to unite with the forces of the north front. On Sept 15 the Russian right flank had been rectified. so that the danger was over. On the 17th the Smorgon salient was straightened. By the end of September the Russian front was straightened on the line Drisbiati-Naroch-Smorgon-Liajovichi. The maneuver was over.

The maneuver was rendered possible by the wire communication which united all the organs of the army with its brain. This was the first important action of the war carried out from start to finish under the personal direction of the Czar.

[On War Fields. By D. Balanin. *Voenny Sbornik,* Mar, '17. 7000 words. 1 map.]

On Sept. 10 the Austrian forces commenced to retire, due to the results of severe fighting unfavorable to them which had occurred with other Russian flanking forces moving on Lemberg from southeast of that city. Consequently when the Russian forces southwest of Lublin moved out on this morning for an attack in force, they occupied without difficulty the hostile trenches in their front. The author comments on the fact that these trenches when now seen at close view appeared much less formidable than when they were occupied in force.

Some hesitation appears to have occured at this time on the part of the Russians in inaugurating promptly a proper pursuit. The author attributes this to a shortage of cavalry. Finally a reconnaisance was sent out consisting of ½ sotnia of cavalry with two guns. This small force, under the direct command of the chief of staff of the 18th Division, marched towards Krasnik, in the vicinity of which it encountered superior hostile forces. Request was made for assistance from the artillery, and some guns, 5500 yards distant opened fire at this range, which, great as it was, was not so great but that it immediately produced a startling effect in the enemy's lines. The author regrets that only a small force of cavalry was near enough to take advantage of the Austrian confusion, but the author fails to state that if pursuit had been made on a broad front with large forces substantial results might have been expected from a force of only 50 or 60 cavalrymen.

On Sept. 11 the Russians commenced their pursuit in force, moving thru Krasnik, and marching in two columns. The total force is stated to have been 28 battalions; 90 guns; 3 squadrons (sotnias); and 2 cos. engineers. From the map, the total distance marched appears to have been about 12 miles. No fighting occurred, as the enemy was not caught up with.

Sept. 12 the advance was resumed at 7 a. m. in one column over a single poor and narrow road. At 9 a. m. the head of the column, having marched some 6 miles came into contact with the enemy's rear guard posted on the south side of the San. Orders for a vigorous attack were at once given. Altho the Austrians made but slight resistance, the entire forenoon was passed in forcing the passage of a small stream and occupying the village of Irene. This was probably due to the one column formation and the state of the roads causing slow developments.

Immediately after this delay, it became necessary to advance through a large forest, 60 miles wide from east to west, and 9 to 13 miles from north to south, which was in the general direction of the march. Roads were very poor thru this obstacle, and only one was available for the author's corps, the other available road in the neighborhood having been allotted to another corps.

The advance was resumed at 1:00 p. m., but was again brought to a halt at 2:30 p. m. by a force of about 6 battalions of Austrians, which were covering both available roads by occupying small villages situated in the forest. The author's corps at once attacked and in the close country the fighting became severe, bayonet actions being frequent. By 5:30 eight Russian battalions alone were engaged about the west road, and the result appeared in doubt. No artillery was being used by either force due to dense woods. The Austrians broke first on the east road, and soon after they likewise gave way on the west road, and the Russians pushed on and secured the further edge of the forest. A few hundred prisoners and some machine guns were part of the fruits of victory. The total Russian advance this day was again some 12 miles, which appears to have been good work, considering the fighting which had to be done.

On the succeeding night the Austrians tried a night attack along the east road. Fighting was continued into the morning and extended over the entire front, although not severe at any point. The Austrians were

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unsuccessful, and the author states that the purpose of their attack was not clear. But it appears that the Russians made no substantial movement forward on this date, and this result in itself would have justified an Austrian rearguard in taking the offensive as it did. The Russian losses this day were small—7 officers and 330 men, but the author comments on them due to the weak strength of the Russian organization.

Sept. 14 was occupied by the Russians in rearranging their forces for an attack to force a crossing over the San, now immediately in their front and defended by the enemy. The attack took place the following day, the XVIII corps on the right and the XVI on the left. The first mentioned corps prepared its attack on a front of 6000 yards by fire from 88 guns, firing slowly in order to economize ammunition. The attack failed and the artillery fire was then increased to as great an intensity as possible. Under cover of this fire, concentrated on a space of some 400 yards in width and some 1100 yards in depth, the attack was renewed and was now successful, the first troops crossing the stream, some 100 yards in width, about 5:30 p. m. By 9 p. m. 2½ battalions had been gotten across.

On Sept 16 the Russians constructed two pontoon bridges across the San. The crossing was not seriously disputed by the Austrians, and the Russians pushed on to Rasvadoov, the Austrian railhead and base, and from which they had partially constructed a narrow gauge railway towards Krasnik and Lublin. Explosions could be seen in Rasvadoov as the Russian forces advanced. Later they occupied the town.

(This completes the author's story of the Austrian advance into Poland in 1914 and their subsequent retreat therefrom. It seems clear that in this part of the field the Austrian troubles arose solely from the driving in of their right flank southeast of Lemberg. Prior to this event, altho they had met brave and severe opposition in their advance on Lublin, they had nearly reached that town, and altho delayed would probably have succeeded in capturing that important railroad and political center. When compelled to discontinue their advance they retired back to their own country in good order, their rearguard accomplishing its mission with comparatively little loss. The main Russian faults were failure to maintain the effective strength of their commands, from which cause their forces became so weak as to lose some of their confidence; failure to initiate a prompt pursuit; lack of co-ordination; and at times poor artillery support.—Ed.)

[The 44th (Russian) Infantry Division on Sept 7, 1916. By S. Dobrotin. *Voenny Sbornik*, Apr, '17. 2500 words. 1 map.]

The mission of the 44th Infantry Division was to advance west from the vicinity of Belz (in northwest Galicia). The division had available three regiments of infantry, the 173d, 174th and 175th, and five batteries, numbered from 1 to 5. One regiment of infantry, the 176th, with the 5th battery, were absent on detached service with the 11th Cavalry Division.

On the previous day this same command had attempted to move west, with an advance guard consisting of the 175th Infantry and the 4th battery; which advance guard at 6 a. m. had been attacked simultaneously in front and on both flanks by a hostile force which the advance guard commander estimated at 12 guns and more than a brigade of infantry. The advance guard remained on the defensive all day, and at night retired to quarters. The main body does not appear to have taken any part in this fight.

During the night reconnaissances were sent out to ascertain the enemy's strength and dispositions, and similar reconnaissances were asked for from supporting divisions on the flanks; but no information of value was obtained.

At 6 a. m., Sept 7, the 175th Infantry reported a hostile column of guns with infantry escort in view in the distance, and was ordered by the division commander by telephone to open fire on this column. As soon as the 4th battery opened fire it was immediately answered by several hostile batteries. The commanding officer of the 175th was soon wounded, and a couple of companies in an exposed position also suffered considerably. The division commander now ordered the 174th to attack the enemy's flank with one battalion, and directed all his artillery to open fire. By 7 a. m. all guns were in action, opposed by what was estimated as 8 hostile batteries. At 8:30 a. m. some of the enemy's batteries were taken under fire by Russian artillery from the 33d Division, which was coming up on the left of the 44th Division, and shortly afterwards the infantry of the former division could be seen advancing. The commander of the 44th Division, in view of these facts, at 8:50 a. m. ordered an assault of the hostile position in his front by the 174th and the 175th regiments under the command of the senior officer present. At about the same time the 173d Infantry was directed to leave one battalion in reserve at the disposition of the division commander, the balance of the regiment to move against some newly reported small forces on the enemy's right; thence to envelop the enemy's flank and rear.

By 11 a. m. the enemy's fire was very heavy, and it was evident that the enemy had more than three regiments present, and that in addition he had a large number of machine guns. The 173d reported its advance as stopped. At 11:30 a. m. the artillery reported that one hostile battery in front of the 174th and 175th regiments had been put out of action, and this information was sent to the commander of these regiments with instructions to seize this battery. At 12:30 report was made that the main attack was held up by the enemy's machine gun fire, and the artillery was directed by the division commander to increase its fire.

At noon information was received that the enemy was turning the left of the main attack; and the division commander at once sent there all the reserve (three companies) left. At the same time he ordered the 174th to charge a village (Radoslav) in its front. This charge was slow in starting, but finally got under way at 2:15 p. m., parts of all three regiments participating, as well as some Cossack troops from another

command. The charge was successful, and the battery previously referred to was here captured and one of its guns turned against the enemy.

The 69th Infantry now arrived as a reenforcement to the 44th Division. The division commander was not informed of the assignment of this regiment to his command until it had nearly arrived. One battalion was at once sent forward towards the left, and orders were given to push vigorously forward. When this was done, the enemy gave way, apparently being willing to give up his whole line as soon as his center had been pierced.

In the entire day's fight 18 guns and 3 machine guns had been captured, together with 8 officers and 543 unwounded men, and in addition 43 wounded officers and more than 1000 wounded men. The Russian losses amounted to 4 officers and 188 men killed, and 23 officers and 669 men wounded, and 150 men missing.

(The principal comment on this action is the lack of results from the Russian reconnaissances, and the planning of a battle on unverified assumptions. While in this particular case the Russians won the fight, this did not always occur at this period of the war, and their dispositions might easily have led to disaster.—Ed.)

[The Russian Front. By Hilaire Belloc. *Land and Water,* May 31, '17. 2500 words.]

The enemy has to guard on this front something more than a thousand miles of line. From the Danube to the Baltic the existing line, without allowing for innumerable local ins and outs, and measured only in its simplest and most general form, is 1640 kilometers long. The portions north and south of the Pripet Marshes afford very different military problems and are treated by the enemy in very different ways. The northern portion, which is less than half the whole, is that portion where he can afford to put his worst troops and can attempt to hold the line with the fewest numbers. The southern portion calls for greater effort and that in an increasing degree as the Ægean is approached.

Of four great army groups, only one—that commanded by Eichorn—is concerned with guarding the line north of the Pripet Marshes. From the river Pripet itself up to the Baltic, the German line extends over nearly 500 miles—800,000 yards—taken in its simplest form without local sinuosities. To hold this very extended line the enemy has the equivalent of 43 divisions. Allowing the average number of men in his now depleted divisions to be a full 15,000—which it almost certainly is not—he would have only 645,000 men with which to watch about 900,000 yards of front.

South of the Pripet Marshes there is a different state of affairs. First comes Linsingen's army group which covers a front of less than 300 miles with 46 divisions; three more than all those employed in watching the immensely longer line north of the Pripet. Of these 46 divisions, two are Turkish, 24½ are Austrian, and 19½ are German. Linsingen's group takes the line down to the Bukovina opposite Kolomea.

South of this comes a third army group, that of the Austrian Archduke, which watches the Carpathian front (densely wooded mountains with very few roads) and extends to the lines of the Sereth. This group has only 17½ divisions, of which four are German.

The rest of the line, from the Carpathians across Rumania to the Danube, and again from the Ægean to the Adriatic in some general fashion is under Mackensen's command.

Under him are no less than 34 divisions. There are eleven German divisions, five Austrian, five Turkish, and thirteen Bulgarian. The Bulgarian divisions are much larger than any of the others. Some of them are probably nearly double.

It is quite certain that nothing can be withdrawn from this fourth army group so long as the Salonika force is exercising its pressure. In fact, as the political situation now stands it is not credible that any one of these four groups—Eichorn's, Linsingen's, the Archduke's, and Mackensen's—can be appreciably weakened.

The whole eastern front, including the Macedonian, and taken right up to the Baltic, accounts for 130 divisions of which not less than 76 are German.

Of the non-German divisions nearly 40 per cent are of a sort that cannot be used elsewhere. They are Turkish and Bulgarian. When it is considered that the Bulgarian divisions are very much larger than the rest, it may safely be said that at least half of the non-German elements are strictly confined to the eastern front without possibility of change.

The whole study of this front in the condition which it showed upon the eve of the great western offensive presents three main features:

(1) The line is held by the least number necessary for that task, given the existing political situation.
(2) The main burden falls upon German shoulders.
(3) Austria, in particular, is suffering severely from the exhaustion of the war.

[The Russian Effort. By Hilaire Belloc. *Land and Water,* July 5, '17. 1600 words.]

On July 1st the central portion of General Brusiloff's army struck the first blow delivered by the Russians since the Revolution of last March.

Divisions from Finland, from Central Asia and from Russia proper, attacked upon a total front of some eighteen miles the sector in front of and north of Brzezany.

This attack puts an end to the system developed by the enemy increasingly thruout the last four months of using the Russian front as a "rest camp." The German Government has gambled upon the asset of a continued security towards the East. While necessarily keeping a certain minimum number of units between the Aegean and the Baltic (the German divisions have never fallen to less than 76 on this

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front) it has at the same time depleted its artillery and its stores of munitions therefor. To reconstruct a full concentration of material is more difficult than to reconstruct concentrations of men and the new Russian attack is of more value on that account. The most important feature attaching to this new offensive is that once more the enemy's Higher Command is faced with the complexity of two active fronts and all that this duality of effort imposes.

The recrudescence of activity on the Eastern front is of the very best augury for the immediate future of the war.

[The Battle of Jezupol. By Hilaire Belloc. *Land and Water*, July 12, '17. 2800 words. 2 sketches.]

General Brusiloff resumed active operations on July 1st on the sector of Brzezany. On July 8th the offensive was shifted and an attack launched by General Korniloff's army, the VIIIth, south of the Dniester upon the sector in front of Stanislau.

By July 10th the operation, evidently still in progress, had achieved the capture of Jezupol, the forcing of the lines upon the Black Bystrzyca, the advance of the Russians at one point as far as the river Lukwo, and consequently the present of the Russian forces upon the flank of the enemy in the important point of Halicz, with the capture of 48 guns, including 12 heavy guns, 131 officers and 7000 of the rank and file of the enemy.

For the first time in a whole year of war the rupture was sufficient to permit the use of cavalry.

[Strategic Value of Stryj. By Hilaire Belloc. *Land and Water*, July 19, '17. 3000 words. 1 sketch.]

When the attack on this sector began the mass of the German troops were under Bothner south of Brzezany. The composition of the forces north of the Dniester was: on the extreme left in front of Koniuchy three Austrian divisions; on the center near Brzezany, two Turkish divisions; then southward on to the Dniester seven German divisions, with four more German divisions in reserve, available within 48 hours for the region south of the Dniester which was not held by troops of the same quality.

Brusiloff first pinned the bulk of the German and Turkish forces in the center by the attack in the Brzezany region on July 1st and 2d. He further deceived Bothner into believing that the battle would develop towards the *north*. As a fact the main attack was made immediately afterwards on the south by General Korniloff who broke the enemy's front opposite Stanislau, and turned and carried Halicz, the bridgehead supporting Bothner on his right and securing the passage of the Dniester, within a week he had forced the Lomnitza and had advanced to and taken Kalusz, nearly half way from Stanislau to Stryj. German troops were concentrated here by the enemy for the purpose of stopping the advance against Stryj. The importance of the place is that it makes a nodal point where the roads and railways supplying the present front converge. Anyone holding Stryj holds the knot of communications upon which the front covering Lemberg depends. Stryj is not a point the occupation of which compels the evacuation of Lemberg itself, but its capture would force the enemy's present line to fall back and would involve for him a grave peril of rupture. If Stryj falls the general line north of the Dniester become impossible—and that is why the fight is for Stryj at this moment.

[The Russian Break. By Hilaire Belloc. *Land and Water*, July 26, '17. 850 words. 1 sketch.]

The Russian front has collapsed on the 25 miles between, and north of, the two railways which converge on Tarnopol. The 607th Regiment abandoned its trenches on July 19th and the local reserves refused to obey when ordered to close the gap left open. The elements to the north and south, were obliged to retire in order to save themselves from envelopment. The line was dissolved and over a space of 25 miles or more a precipitate retreat began. By July 23d Tarnopol was in enemy hands and the Russian line in Eastern Galicia had ceased to exist in any true military sense.

The one point of relief is that in the presence of chaos the enemy cannot for the moment weaken his Eastern front. The situation, bad as it is, is better than it would have been had an organized nation with disciplined armies accepted peace. The enemy needs, and will need, including his Austrian, Turkish and Bulgarian Allies, not less than a million and three-quarters between the Black Sea and the Baltic.

No breakdown on the Russian side, nor even negotiations by any fraction of what was once the Russian Empire, can guarantee him so far against the necessity for continued vigilance.

[Riga and the Western Front. By Hilaire Belloc. *Land and Water*, Oct 18, '17. 2000 words. 2 sketches.]

The action of the German Fleet against the Gulf of Riga is so far only partially a military operation. It is the occupation of a maritime point by troops under the cover of a fleet.

The Gulf of Riga is roughly oval in shape not quite 90 miles in breadth and about 100 miles in extreme length. It is almost completely land-locked, being cut off from the sea by the Island of Oesel and the smaller Islands of Dagö and Warmsö. The northern entrance is impracticable for large boats, being narrow and shallow and completely commanded by shore batteries.

On the south, between Oesel and the mainland there is a passage into the Gulf 18 miles in width, the fairway being some 8 or 9 miles wide with a depth of from 11 to 14 fathoms. There is a bar outside full of shoals with a narrow and tricky channel having but 7 fathoms at its deepest. This passage the German Navy was unable to force in the days when the Russian Empire still existed and possessed a properly organized military and naval force. Even as things now are the Germans did not attempt this passage but struck for the islands forming the breakwater of the Gulf.

On Oct 10 German aircraft dropped bombs upon Russian shipping lying in the Gulf. On Oct 12 two landings were made under cover of the fleet. The first

landing was effected in Tagelacht Bay on Oesel. The second landing was effected near Serro on Dagö. By Oct 13 Oesel, which had but a small garrison, was overrun by the enemy. According to Russian accounts the force landing on Dagö was defeated and driven back to the ships.

It would appear that the operation as a whole was designed for the mastery of the Gulf and for further action on its eastern shore behind the Russian lines, with the object of turning them. This would compel the retirement of the Russians, thus uncovering all the marshy country to the north, including Reval, the chief base of the the Russian Fleet. The Riga line would be completely turned and all Esthonia exposed. All this is mere conjecture however, as it is not known in what strength the attack is being made. The certain thing is that Germany can do pretty well what she likes in this region.

On the Western front attacks were made on Oct 9 and Oct 12 against Passchendaele Ridge. Both attacks reached the objectives assigned them. They further resulted in the capture of some 3000 prisoners of whom 400 were taken by the French.

Heavy rains rendered the last assault exceedingly difficult.

Rumania

[Enemy Attack on Rumania. By Hilaire Belloc. *Land and Water*, Oct 19, '16. 3000 words. 3 sketches.]

The principal interest of the moment turns upon the Teuton attack against Rumania. There would seem to be three converging movements. The first is directed across and against the Oltuz Pass. The second against the southern passes, particularly just in front of Kronstadt whence an advance directly threatens Bucharest. The third is the threat of a crossing of the Danube near Sistova to the south of Bucharest. The Rumanians have retired almost entirely from Transylvania and their forces on the Carpathian front are occupied in maintaining a defense of the passes which are the gateways to their country. Oltuz Pass is reported to be threatened with an exceptionally heavy concentration of the Teutons. The second attack against Rumania is developing against the southermost group of passes. The Pasul Bran (called by the Austrians the Torzburg Pass) is the westernmost of the two passes which converge upon Kronstadt. It has been chosen by the Teutons because of its superior lateral railway communications. If the Teutons strike against the Predeal Pass, the Pasul Bran and the Red Tower Pass they (1) attack from positions where their lateral railway is close behind them, and (2) attack against Rumanian columns which have no lateral railway communications behind them. For the attack is west of Ploesti which is the end of continuous lateral communication on the Rumanian side. Falkenhayn has been able to use the railway to swing a mass of maneuver which he could muster at short notice against each of the isolated Rumanian columns in succession, and that has the striking power of nearly all of the forces under his command in this region. His total forces amount to about 10 divisions. He relies for success chiefly upon his superiority in heavy guns.

Bucharest is the great point of concentration for supply and the nodal point of communications in Rumania. It is perhaps the most perfect ring fortress in Europe with a road and a railway connecting the whole circular chain of forts. These protect the junction of the four railway lines and six main roads which branch out from Bucharest serving the entire region.

[Mackensen's Success. By Hilaire Belloc. *Land and Water*, Oct 26, '16. 1600 words. 1 sketch.]

Mackensen's successful attack in the Dobrudja, the fighting in the passes, the stabilization of the Russian front, all mean the same thing—munitions. The *penury* of men upon the Teuton side is the striking feature. From Riga to the Danube the Teuton advantage is that of munitionment and of heavy guns.

The Allies' entrenched line in the Dobrudja was subjected to an intensive bombardment which they were unable to meet on equal terms, consequently Mackensen broke thru on the left or Black Sea end. The left wing of the Allies fell back towards the northwest to cover the bridgehead of Czernavoda. This retreat uncovered Constanza and Mackensen entered that port on Oct 22. If Mackensen's superiority in munitionment breaks down the defense of the Czernavoda bridgehead as it broke down the entrenched line of Tuzla, then the Danube stands for an indefinite time as an obstacle between the northern and the southern sections of the Alliance in the East.

[The Rumanian Defense. By Hilaire Belloc. *Land and Water*, Nov 9, '16. 3200 words. 1 sketch.]

Much attention is attracted to the Rumanian field of war because it is a field in which movement is occurring on a considerable scale, and also because it is the theater of the only Teuton offensive.

The object of the Teutons here is three-fold. First, defensive: to prevent Rumanian and Russian troops from threatening Bulgaria from the north, and with Bulgaria the communications with Turkey.

Secondly, offensive: The invasion of Rumania thru the Carpathian passes. Thirdly: a movement across the Danube, if that be possible, in co-operation with the last.

The first of these objects has been amply attained. As to the second, Falkenhayn's main effort at invasion proper has lasted now just five weeks. His maneuver at first was to hold upon his right and move his left with the object of forcing the northern passes, and thus cutting the communications between the Rumanians and the Russians. The second maneuver was a change of plan,—namely; to hold the northern passes and attempt to force the southern ones. The first maneuver failed. The second is still proceeding.

With reference to the third object, it is possible for Mackensen to establish a bridge-head on the Rumanian bank of the Danube, but this would be a doubtful experiment. Superiority in heavy artillery is, of course, presupposed in such an attempt; this superiority the Teutons possess. The difficulty to them would lie in their scarcity of men. The land on the Rumanian bank of the Danube is so marshy that an advance

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by the invaders would necessarily be over narrow causeways without deploying room, and with no good observation points from which to direct artillery fire. The odds are against the success of such an attempt.

[The Rumanian Retreat. By Hilaire Belloc. *Land and Water*, Nov 30, '16. 1900 words. 1 sketch.]

(The opinion is advanced in this article that the retreat of the Rumanian armies was caused by lack of munitionment. The facts of Mackensen's successful crossing of the Danube and rapid advance from that river, and the sudden withdrawals of the armies without appreciable losses in men killed or guns captured are cited in proof of this theory.)

[The Rumanian Situation. By Hilaire Belloc. *Land and Water*, Nov 23, '16. 1200 words. 2 sketches.].

Shortage in men was the general reason for the inability of the Central Powers to preserve their last ally from local disaster at Monastir. The particular reason was the fact that they chose to concentrate all available strength for the offensive against Rumania.

In a Berlin dispatch of Nov 18 the Teutons claim to have defeated the Rumanians at Vulcan Pass, and to have thrown their cavalry forward to Filassi Junction, the Rumanians retreating further to the eastward. This retreat uncovers the western Rumanian plain and implies the isolation, or loss, of the Rumanian troops occupying Orsova, and also the loss of the Rumanian hold upon the Danube.

The reverse may have been due not only to inferiority in heavy pieces, but to a general exhaustion in munitionment. If that be so, all "normal" strategic study of the situation loses its value. A force which has failed in munitionment is no longer an army.

[War Notes. By Capt. H. M. Johnstone, R. E. (retired). *United Service Magazine*, Nov, '16. 4000 words.]

(Chronological discussion of Mackensen's Rumanian drive.)

[War Notes. By Captain H. M. Johnstone, R.E. (retired). *United Service Magazine*, Jan, '17. 4400 words.]

(Résumé of the Rumanian Campaign.)

[Lessons in Strategy and Politics. By Col. Feyler. *Land and Water*, Dec 14, '16. 1400 words.]

When the Rumanian intervention occurred there was general expectation of Austro-Hungary's complete exhaustion. It was also taken for granted that Bulgaria, placed between two fires, would shortly collapse.

The mistake that Rumania made was in forgetting the axiom of strategy that when one is only a unit in a whole it is an imperative necessity to subordinate one's movements to the general plan.

A fundamental principle of military operations declares the object of strategy to be the destruction of the enemy. If there are several enemies, the attempt should be made to destroy the most dangerous one first. In the present war the principal enemy on the Teutonic side is the German Empire. No one will dispute that the war will end when that enemy has succumbed. Hence the importance of the western and Russian fronts, on which Germany is attacked directly at the points nearest to her vital parts.

Rumania violated the principle of concentration of the maximum possible force against the most dangerous enemy. She made the mistake of directing a campaign against two enemies simultaneously, distributing her forces between the Austro-Hungarians on the west and the Bulgarians on the south, instead of arraying the mass of them against that one of the two whom it was of consequence to put out of action first.

Strategical logic has taken its revenge. It always does.

[The Lines of the Sereth. By Hilaire Belloc. *Land and Water*, Dec 14, '16. 200 words. 2 sketches.]

The Rumanian situation is one in which no discussion of military movements and their effects is of value, because the two opponents are not comparable. The Rumanian army is deficient in shell and heavy guns. The great question is: "When will munitionment appear in sufficient quantity to enable the Russians and Rumanians to check the enemy's advance?"

The Rumanian army held its own on the defensive mountain line so long as its stock of shell lasted. The last considerable stock was exhausted in the fighting south of Vulcan Pass. The shortage came suddenly and probably unexpectedly. The bulk of the army fell back then upon Bucharest presumably because a certain amount of shell was to be found there. Hence the rally in the immediate neighborhood of the town. Again the stock was exhausted, and the army forced to retire. This army was unable from lack of shell to oppose the crossing of the Danube. It was unable for the same reason to stand upon any line.

The enemy pressure is not of numbers but of shell.

The total number of his forces between the Bukovina and the Danube was, just before the fall of Bucharest, only 26 divisions; 12 German, 12 Austro-Hungarian, 1 Bulgarian and 1 Turkish.

The Rumanians in withdrawing cannot use the factor of unlimited space as did the Russians. The enemy's communications improve as he advances, and his line is shortened.

Should Falkenhayn desire to establish the shortest line consistent with the continued belligerency of Rumania he will find that line upon what are called "the lines of the Sereth." These lines were constructed under German supervision upon the system known as that of Schumann. Three detached open lunettes, each consisting of three concentric half circles were constructed facing northwards intended to check a Russian advance from that direction. The three works defend a gate between the mountains and river only 50 miles wide. The work covering Focsani is the most important. The whole extension of the enemy's line due to the entry of Rumania into the war was over 700 miles. Occupation of the line from the elbow of

the Carpathians thru Focsani to the Sereth, and so on to the mouths of the Danube, would reduce this extension to only 300 miles.

[The Rumanian Campaign. By Hilaire Belloc. *Land and Water*, Jan 4, '17. 1700 words. 2 sketches.]

A discussion of the value to the Austro-Germans of the capture of Oitoz Pass and of Onesti. The serious points about the capture of this Pass would be the loss of the shortest line between the Carpathians and the Danube and the gradually extending front which the Russians would be compelled to maintain should the Braila-Focsani line be turned. The aggregate of the enemy forces between the Carpathians and the Black Sea is estimated to be over 200,000 men.

[The Rumanian Campaign. By Col. Feyler. *Land and Water*, Jan 4, '17. 1800 words.]

Operations in this campaign were twofold. An army of but slight offensive importance and in which Russia was represented only by two infantry divisions and one cavalry division, advanced in the Dobrudja, on the southern bank of the Danube, opposite Bulgaria. Another army which seems to have been much more considerable invaded Transylvania thru all its frontiers, thus marching against Austria-Hungary.

This twofold operation would have suggested that the intention was to make a simultaneous attack upon the Bulgarians and the Austrians. Two circumstances prove that this was not the real intention: one, that Rumania declared war only upon Austria-Hungary; the other, that after the first encounter in the Dobrudja the Russo-Rumanian army was obliged to give ground to a great depth. The conclusion is that Rumania regarded the Balkan front as merely subsidiary, that the mission of the Dobrudja army was purely defensive, and that the real strategic plan contemplated securing the initiative which was to be looked for on the Austro-Hungarian enemy front. This plan was erroneous in conception and did not correspond with the general situation. The definite issue was that Bulgaria maintained her position and the Germans consolidated theirs, while the Rumanians, failing to concentrate against the principal enemy, were driven out of half of their territory. The result of this campaign was not all loss, however, since it caused Marshal von Falkenhayn's army to be diverted from a more important objective.

[Campaign Against Rumania. By the Danube to Bucharest. By the General Staff of the Army of Mackensen. *La Guerra y su Preparación*, Apr, '17. 3000 words. 18 photographs, 1 map.]

In October, 1915, the armies of Mackensen crossed the Danube from north to south in an invasion of Serbia. Over a year later they were again prepared to cross the river for an invasion from south to north. The opportune moment had arrived as the liberators of Transylvania under von Falkenhayn were penetrating the plains of Wallachia, and the Rumanian resistance was commencing to weaken.

The difficulties confronting the Germans were the presence of the enemy, the breadth of the river (1 kilometer), the weather, the height of the water and the conditions of the terrain. It was supposed that the increase of traffic would warn the enemy of the intended crossing. The Germans gathered a strong mass of heavy artillery on the south bank near Svistov. The crossing was to begin at Svistov and Belene at 7 a. m., Nov 23. A thick fog delayed the crossing until 10 a. m. The first pontoons were put in motion at that time. At a number of places along the river false demonstrations were made, and the enemy expected a crossing at Silistria. The islands of Kalnovec, Vadim, and Popadija were occupied; Corabia, on the north bank, was seized. There was little resistance.

The leading infantry which crossed at Svistov was accompanied by officers of liason, and soon the artillery commenced fire. The enemy evacuated Zimnicea, being completely surprised. On the evening of the 23rd the infantry of three divisions, and some batteries, established a bridge-head north of Zimnicea, under whose protection the construction of a bridge was begun. The skillful co-operation of the Austrian Danube fleet aided in the crossing.

The work of the technical troops was remarkable. After 22 hours a bridge was ready for the passage of heavy artillery. Telephone and telegraph cables had been laid across the river in one hour and thirty-five minutes.

The Rumanians continued completely ignorant of the German plans. On the 24th the bridge-head was extended to the line Fantanele-Nasturelu and a cavalry division advanced to the north to cover the left flank. Falkenhayn's army was fighting on the Alt. The mission of the cavalry of both armies was to effect a junction at Alexandria, on the Veda. The cavalry of the army of the Danube reached Alexandria Nov 26, but the Ninth Army was checked, and contact was effected at Plosca on the 27th. The army of the Danube, with the right wing on that river, and the left at Smardicasa advanced to the northeast.

On the 27th Giurgiu was taken with the aid of the garrison of Rutschuk. On the left Prunaru was occupied, after a bloody battle. Under the pressure of this advance the army opposing Falkenhayn commenced a retreat to the southeast, falling into the hands of the army of the Danube. An energetic offensive thru Alexandria toward Svistov in the interval between the infantry of the two German armies might have saved them. Later the Rumanians attacked the left wing of the army of the Danube from the line Bulbacata-Mereni, but the Ninth Army had reached Blejesti, and the Rumanian attack was too late. A series of confused fights followed in the region Epuresti-Bulbacata-Balaria-Ghimpati. The Rumanians had some local successes, but had no definite plan of operation. On Nov 29 the army of the Danube threw the enemy across the river Glavaciocu, and established itself on the line Galugareni-Monastirea-Tangir-Copaciu. A Turkish division in reserve occupied Draganesti. The cavalry had reached Clijani. The right wing of the Ninth army was at Mihaesti. In the following days

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the army of the Danube occupied points on the Neajlovu. At this time the enemy which was retiring from before the Ninth Army attacked the Turks at Draganesti, but was defeated. On the 30th the right wing of the Ninth Army occupied Cascioarele and other points on the Argesul. The railway Pitesti-Bucharest was crossed. Strong attacks by Russian and Rumanian forces on the right of the army of the Danube were unsuccessful.

During the night of the 30th the Bulgarian division near Popesti had to retire, and on Dec 2 German forces were driven back to Epuresti. The rear guard of the left the army of the Danube, thus menaced, was rescued by a division of the Ninth Army advancing from Coleasca.

On the 3rd the Germans again advanced, reaching Buda. On this day the Rumanians lost 5000 men prisoners, 39 guns and 3 machine guns. Meanwhile the Ninth Army forced the passage of the Argesul at Malu Spart, seized the bridge of Fundu Parului, and reached Odobesti. The enemy was still resisting Gen. von Kraaft at Pitesti but on this date the Rumanian strength was broken. They were in full retreat at all points and the last decisive attempt to save Bucharest had failed. A Russian offensive in the Dobruja by way of diversion, was ineffective. On the 5th, the enemy had evacuated all points south of the Argesul; the Ninth Army and the Army of the Danube were in conjunction at Saxoni.

On the same date Mackensen sent a demand for the surrender of Bucharest, within 24 hours. On the 6th, the cavalry occupied a fort on the road Mogosaia-Bukarest, and detachments of the Ninth Army seized the forts between Chiajna and Odaile. The Rumanian forces evacuated Bucharest. The Germans entered at 2 p. m. and were received with joy by Germans and Austrians released from prison and by pro-German Rumanians. On the same day, Ploesti fell into our hands, and Rumanian forces on the Alt, retiring from Orsova, surrendered. 10,000 men and 26 guns fell into our hands.

In this campaign the Rumanians lost, in prisoners, 285 officers, 36,000 men, 170 guns, 50 machine guns, and 12 grenade-throwers.

[The Conquest of Rumania. By Douglas W. Johnson. *Geographical Review,* June, '17. 8000 words. Map and illustrations.]

The hopes of the Allies ran high with the entrance of Rumania into the war. Her army was supposed to be the best of those of the Balkan states, and her material resources were important. But the hopes were destined to be unfulfilled.

The explanation is in part geographical and in part political. Rumania is wonderfully well protected by natural barriers. From Bukowina to the Iron Gates of the Danube, the frontier is covered by the Transylvanian Alps. (These are described in detail. The range on the Moldavian frontier is usually less than 5000 feet high, and on the Wallachian frontier 8000 feet and over.)

Nine passes, in three groups, traverse this range. The northern passes comprise the Bekas Pass, crossed by a wagon road; the Gyimes Pass, traversed by wagon road and railroad; and the Oituz Pass, with a good wagon road. Farther south an inferior road crosses a less important gap. The central passes include two of importance, the Predeal Pass, traversed by the high road and railroad from Bukharest to Kronstadt, and the Törzburg Pass, crossed by a first class wagon road. The western passes include the remarkable Red Tower Pass, which is the gorge of the Olt River, traversed by road and railroad leading from western Rumania to Hermannstadt; next west is the Vulcan Pass, which is the gorge of the Jiu River, with only a wagon road; and the last is the Iron Gates of the Danube, occupied by both road and railway. All of the northern and western passes are the gorges of streams rising in Hungary and flowing into Rumania, thus making them easier to traverse toward Rumania.

The southern frontier of Rumania is formed by the Danube, a great river, a half mile or more wide and very deep. The river is split into two or more channels frequently by marshy islands, and a broad belt of marsh borders the river on both sides, making a very formidable obstacle. There is no bridge between Belgrade and Cernavoda, a distance of 500 miles.

The Rumanian province of Dobrudja lies south of the lower Danube, and its frontier has no natural protection.

There were two possible plans of offensive campaign, an invasion of Transylvania or a movement south from the Dobrudja against the Orient Railway. The latter was more distant from Rumania territory than at the Iron Gates but more accessible nevertheless. Rumania could not undertake both of these operations at once, and chose the invasion of Transylvania for political reasons to recover a lost province.

For a period this invasion progressed, but met with increasing resistance and it was finally checked. When the advantages were sufficiently in their favor, the Teutons fell upon the Rumanians and drove them back to the passes. Meanwhile, realizing the danger of a threat against the Orient Railway thru the Dobrudja, von Mackensen began his campaign in this theater. He drove back the Rumanians, even tho the latter were assisted by Russian reinforcements, until the narrow part of the Dobrudja was reached and the destruction of the Cernavoda bridge compelled. Thus the chance of a Rumanian offensive in this quarter was destroyed.

Meanwhile, von Falkenhayn hammered at the passes week after week. An advance thru the northern passes promised the most decisive results, but violent attacks failed. Next the central passes were tried, but the power of the defensive in mountainous country could not be broken. By the middle of November, von Falkenhayn had battered at the northern and central passes without any real success, and he was now forced to try the western passes, which promised a still smaller reward, but greater certainty of at least some success. Vulcan Pass was chosen for the supreme at-

tempt. The fighting was very severe. Finally outmatched in artillery the Rumanians finally yielded and the Teuton floods poured thru. The Transylvanian Alps and the Danube line were thus broken. Then followed a swift but orderly retreat by the Rumanians, forced by a shortage of munitions due, not to difficulties resulting from poor supply lines, but to the fact that Rumania depended upon Russia for aid, and the disloyalty which disarranged the Russian supply system worked the undoing of Rumania as well.

Then followed a series of operations in which the critics went astray. From the Olt River the Rumanian army withdrew to the Niaslov, and then to the Arges. The latter line was supposed to cover Bukharest, but the railroad was on the wrong side of the river and the line yielded. Then followed the difficult retreat to the northeast, pivoting on the right wing. Large Russian forces joined the Rumanians and the increasing ruggedness of the country toward the pivot made the maneuver possible. Delaying actions were fought at the Jalomitza River, and at the Buzen. Geographic conditions prevented a serious stand at the latter river, because the line bent too far to the north at its eastern extremity giving rise to a dangerous situation should the line be broken, and in addition the railroad was again on the wrong side of the river. After a sharp fight on the Ramnic River, the Russian-Rumanian forces took up their final stand behind the lower Sereth and Putna Rivers.

An examination of the topographical configuration shows why this line could be held. A marshy flood plain supplies a sufficient obstacle except from below Foscani to Fundeni, but here the Sereth backs up the line. Below Fundeni the great marshes of the lower Sereth begin and then follows the impassable barrier of the lower Danube. The railroad lines were sufficient for supply. The Teutonic forces arrived before the Sereth-Putna line during the first week in January, 1917. They attacked north of Focsani but failed, and later near Galatz Vadeni was captured but no further progress could be made. Later Fundeni was attacked and notwithstanding the use of the best of the Teuton troops, the line could not be broken. February found the fighting still in progress and the strength of the defensive line began to be evident.

The western end of the line was also tried out. The fighting at Oituz Pass was extremely heavy for weeks. Four separate columns marched against Onesti, but the defense in the narrow valleys could not be broken. Every attempt to reach the Trotus valley failed. The difficult mountain topography protected the western flank as effectively as the marches did the eastern flank.

[The Rumanian Campaign of 1916. By Colonel K. Egli. *Schweiz. Monatschrift aller Waffen,* Jan-July, '17. 20,000 words.]

(This article gives a good survey of the military operations and of the political and diplomatic events which influenced Rumania's conduct of the war.)

1. *Rumania's Position at the Beginning of the European War*

Rumania had a military alliance with Austria-Hungary and Germany and her fortresses were built against Russia. When the Great War broke out King Carol tried in vain to secure his country's participation on the side of the Central Powers. The prominent politicians and popular opinion favored the Allies. But King Carol kept Rumania neutral to the end of his life.

2. *From the Death of King Carol to the Great Russian Offensive in June*

King Carol died on Oct 10, 1914, and his successor, Ferdinand, could not prevent Rumania's participation in the war. The Rumanian statesmen were waiting until the superiority of one of the belligerent groups seemed fully established and they intended to join the victorious side. Such a policy was expected to secure the greatest possible advantages without incurring great risks. During this period of waiting practically nothing was done to strengthen the defenses of the country or to prepare the army for modern warfare. On May 12, 1916, a conversation took place between the Rumanian premier Bratianau and the Austro-Hungarian minister Count Czernin, in which Bratianu frankly admitted that he would attack Austria-Hungary as soon as he thought the Dual-Monarchy was about to collapse.

3. *From the Russian Offensive in June, '16 to Rumania's Declaration of War on Aug 27 of the Same Year*

In June, 1916, Russia's successes in Galicia hastened Rumania's entry into he war because Bratianu expected the war to end soon with the dismemberment of Austria-Hungary. Before the campaign could begin Rumania had to harvest her crops, and to complete her military preparations. During July and August the ammunition supplies were increased to 3000 rounds for each field piece. It was hoped that Bulgaria would not attack, that Sarrail would start his long expected offensive, and that Germany would be fully occupied with her Western front.

Probably a military agreement was concluded with Russia by the middle of August, and the declaration of war was dispatched to the Rumanian minister in Vienna with the order to have it presented at nine o'clock on the evening of Aug 27. On the night of Aug 26-27 Bratianu assured Count Czernin of his intention to remain neutral, altho the declaration of war was already on its way to Vienna. In the morning of Aug 26, King Ferdinand told the Austro-Hungarian minister that he did not want war and that ninety per cent of the people were against it, but he admitted that an attempt of the Russian army to march thru Rumanian territory could not be prevented. Since the Rumanian army was more than half a million strong a Russian violation of Rumanian terriory was apparently possible only with the connivance of the military authorities.

When Bratianu decided to enter into the war on the side of the Allies he failed to include in his calculations the following facts:

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(a) Austria-Hungary was not at the end of her defensive strength.
(b) Germany was still able to help her ally.
(c) Bulgaria was not immobilized in Macedonia, nor unwilling to fight against Russia.
(d) Turkey was able to send reinforcements.

He also overestimated the amount of help he could receive from Russia and he failed to understand Rumania's unpreparedness for a modern campaign. The Rumanian general staff had neglected to inform the government about the exact conditions of the army.

4. *The Organization of the Army at the Outbreak of the War*

In 1913 the Rumanian army consisted of five army corps, each of two divisions, each division comprising thirteen battalions and twelve batteries. There were, besides, ten brigades of cavalry, totalling eighty-four troops, five sections of field howitzers with fifteen batteries, one section of horse artillery with four batteries, one regiment of mountain artillery with four batteries, one section of heavy field howitzers with two batteries, and the necessary units of engineers and fortification artillery. The Second Line consisted of depots for eighty battalions, twenty-one troops, and twenty batteries. On the Danube were four armored gun boats, each of 680 tons, armed with three 12 cm. guns and two 12 cm. rapid fire howitzers. There were also eight patrol boats, etc.

This army had been successfully mobilized in 1913 against Bulgaria. It probably consisted of about 600,000 men when mobilized again in June and July, 1916. This number is not too high for a population of 7,500,000 people, if 10 per cent be taken as the average percentage of the population's available military manpower. In 1916 were organized eighteen divisions of the first line and six of the second line, but it was impossible to create all the additional artillery, necessary for these divisions. Some heavy artillery was received from Japan, Russia, and France shortly before the outbreak of hostilities, but neither officers nor men were sufficiently trained for their handling.

The tactical training of the Rumanian generals for modern warfare was inadequate. They had paid no attention to the lessons taught by the great war, and their knowledge of strategy did not extend beyond Mars-La-Tours and Gravelotte. The field service training of officers and men was insufficient for modern combat and their enormous losses are directly traceable to this fact.

The Rumanian infantry was not only taken by surprise by the effect of the German and Austrian heavy artillery, but they also knew very little about modern auxiliary arms. The regular army officers were either the spoiled progeny of the rich landowners or the sons of the poor bureaucrats. The reserve officers were despised by their comrades of the regular army, especially if the former were country school teachers. Many officers deserted during the retreat of the defeated army.

The outbreak of the war came unexpectedly to the Rumanian troops. They had been ordered to the frontier under the pretext of peace maneuvers and, not until they had reached it, they were informed about the real situation. The complete mobilization of the army did not take place until after the declaration of war. The reserves were largely untrained. The commanding officer of the 79th Infantry Regiment, Lieutenant-Colonel Betea, reported on Nov 26, 1916, to his division commander: "More than half of my men have never fired a round of ammunition and lack the most elementary combat training. The regiment has no ambulances, no first aid supplies, no complete equipment. Each company is commanded by a second lieutenant of the reserve, the battalions by first lieutenants. The noncommissioned officers have no training whatsoever."

5. *Rumanian Strategic Moves During the Last Days of August*

Rumania had to consider a war on two fronts and could choose between two alternatives: (a) Her main army invades Transylvania and she takes a defensive position on her southern front in the Dobruja, supported by Russian auxiliary troops. (b) The main forces of Rumania crush Bulgaria with the assistance of the Russians and of Sarrail's army. Transylvania is invaded after the southern front has been secured.

The first plan was more popular with the Rumanian statesmen while the other one was preferred by the Allies. A successful attack upon Bulgaria would cut the Central Powers' communications with Turkey, and possibly restore Servia, but it would have exposed Rumania to an attack from the North which would be nothing short of a disaster, if successful. An immediate invasion of Transylvania was considered the most advantageous move and this decision was probably justified, especially in view of Russia's growing pressure upon northeastern Hungary.

The invasion of Transylvania could be carried out in the following directions: (a) From Moldavia over Ocna-Czik Sereda and further on in a western direction thru the Görgeny Mountains against a line running thru Szasz Regen-Maros Vasarhely with the right flank secured by the Kelemen Mountains and, if possible, in touch with a Russian army operating over Kimpolung from the Bistritza Valley. (b) From Wallachia over Ploesti-Kronstadt and by deploying south of Schässburg into the space southwest of Maros Vasarhely. (c) From Wallachia over Rimnik Valcea-Hermannstadt towards the valley of the Maros at Mühlbach. The left flank must be secured by the occupation of the Vulcan Mountains. The western frontier of Wallachia could be protected by detached troops at Orsova.

If the Rumanians were able to push far enough to occupy the heights north and west of the line Gyergo St. Miklos-Czik Sereda-Kronstadt-Fogaras-Hermann-

stadt, they would have close behind their front, in the valley of the Alt, excellent means of communication.

The actual invasion took place along the railroads entering Transylvania at Czik Sereda, Kronstadt, and Hermannstadt. The following plans were carried out: (a) The fourth Rumanian army under General Preslan marched over the Gyimes Pass, sending a parallel column over the Tölgyes Pass and detachments thru the Keleman Mountains. (b) The second army under General Avarescu used the excellent mountain passage between the Oytoz Pass and Törzburger Pass, taking a northwestern direction toward Kronstadt. (c) The first army under General Culcer marched over the Red Tower Pass with a parallel column over the Szurduk Pass. This army was handicapped by having to divert forces for the protection of the western frontier of Wallachia. Its principal objective seems to have been the open space north of Hermannstadt. The first Division was for the protection of the Danube near Orsova. This first army was the weakest of the three armies of invasion and later it was the first one to crumble under the powerful Austro-German counter-attacks.

The three armies made very slow progress and failed to get fully deployed. They seemed to have executed a slow turning movement with their pivot south of Hermannstadt and the moving flank in the difficult terrain of the Görgeny Mountains. They were too widely separated to support each other and were, in consequence, later defeated one by one.

The third Rumanian army stood in the Dobruja and consisted of four Rumanian, one Russian and one Serbian division. Later a second Serbian division was added. These forces were inadequate for a strong offensive. Their task could only have been to gain time until help was forthcoming from the Allies or from the main army in Transylvania. Their defensive position should have been strengthened by modern fortifications on the Danube bridgeheads at Tutrakan, Silistria, Cernavoda, and Hirsova. But these had not been provided before Rumania's entry into the war and now it was too late to construct them.

6. *The Campaign in the Dobruja and in Transylvania, to the Beginning of October*

The commencement of the hostilities took the Rumanian army as much by surprise as their adversaries. In order to conceal the war preparations, the mobilization was not completed before declaring war and much less was the Rumanian army by that time strategically deployed. The weak Austro-Hungarian frontier guards withdrew, not without inflicting serious losses to the invaders. As soon as the Rumanians had occupied the Hungarian border districts, they intrenched themselves and remained inactive.

The first counterattack came from Bulgaria. The next day after Rumania's declaration of war against Austria-Hungary Field Marshall von Mackensen took charge of a mixed army of Germans, Austrians, Bulgars, and Turks south of the Dobruja, and on Sept 1, Bulgaria declared war on Rumania. In the following night the Bulgars crossed the Rumanian frontier and by the evening of Sept 2, the Rumanian and Russian outposts were driven in. On Sept 4, Dobric was taken. But Mackensen left only one brigade at Dobric and directed his forces against the bridgehead at Tutrakan while the Rumanians concentrated troops before Dobric. Tutrakan was held by forty-one battalions with twenty batteries and six troops of cavalry, and its fortifications were protected by a hundred heavy pieces. On Sept 4, these forces were attacked by inferior numbers under Mackensen and had to surrender on the 6th, twenty-eight thousand Rumanians were made prisoners and great stores of war material captured. The next fortified place to fall was Silistria which was taken Sept 10, and by Sept 15 the entire Rumanian and Russian forces in the Dobruja had to retreat. But new Russian troops arrived and also Rumanian regiments from the Carpathians and the retreat was halted on previously prepared lines running thru Cobadinu-Topraisar. The operations in the Dobruja were now for a while suspended.

During the second half of September the campaign in Transylvania made rapid progress. The invaders were first confronted by Austro-Hungarian Landsturm formations and a few divisions of first line troops, under the command of General von Arz, who avoided decisive engagements. North of Hermannstadt an Austro-German army under General von Falkenhayn was formed. Also General von Arz received enough reinforcements to organize an entire army.

The first Rumanian army had remained inactive south of Hermannstadt, which town was occupied on Sept 2 by advanced troops, but evacuated on the following day. The absolute inactivity of the first Rumanian army permitted Falkenhayn to organize his forces north of Hermannstadt without any hostile interference. A detachment of the first army had crossed the Szurduk Pass and had moved a short distance beyond Petroseny into Transylvania and the first division had entered Hungarian territory at Orsova, but also remained inactive.

On Sept 14 the Rumanians were driven back over the Szurduk Pass. On the following day the First Rumanian Army came in contact with the Ninth German Army, north of the Red Tower Pass. A week later the Rumanian attacks had reached their greatest violence. Falkenhayn held his main forces back but sent an Alpine division under General Krafft von Delmingen around the left wing of the enemy in order to cut the line of retreat of the First Rumanian Army. This was accomplished in four days and now Falkenhayn attacked with his main forces. Violent fighting lasted from Sept 26 to 28 and the first Rumanian army which had not received any support from the other armies was practically destroyed.

Falkenhayn left the Alpine division in the mountains to secure his rear and right flank, attacked the Second Rumanian Army on Oct 7 at Kronstadt, and threw it across the frontier by the 10th. The Fourth Rumanian

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Army had reached Szasz Regen, but was forced to retreat when confronted by the army of General von Arz.

The complete failure of the invasion of Transylvania was largely due to the absolute lack of co-operation on the part of the different columns which remained more or less inactive until attacked, instead of advancing and occupying valuable strategic positions. Falkenhayn was able to defeat each army group with a force which was inferior in numbers to any one of them. Responsibility for the Rumanian disaster lay partly with the insufficient military experience and training of the troops and the lack of adequate ammunition reserves, but the principle cause for the defeat must be sought in the strategic inferiority of the Rumanian generals.

7. *The Defense of Rumania's Transylvanian Frontier During October and November*

Rumania depended upon her own resources for the defense of her soil against an invasion. The assistance, received from her allies, consisted of weak Russian and Serbian reinforcements. She expected the Austro-German attack to develop thru the Transylvanian Passes leading into Wallachia and therefore she had fortified them, altho inadequately. When the enemy appeared on the frontier it was too late to modernize these defenses. Nor did Rumania organize a sufficiently mobile army reserve. On Nov 11, a comparatively weak German detachment, two infantry divisions and one cavalry corps, forced the passages of the Vulcan Mountains and overran all western Wallachia.

8. *The Loss of Wallachia and of the Dobruja*

While the Rumanian army was still trying to hold Targu-Jiu against General Kühne's divisions after the latter had crossed the Vulcan Mountains, a cavalry corps under General von Schmettow passed the Rumanian left flank and captured the railroad center of Craiova, on Nov 21. From Craiova the Germans turned east and reached the Alt River east of Caracul on Oct 23. Meanwhile the Austro-German infantry had reached the Alt near Slatina.

In the Dobruja the Russo-Rumanian forces had made slight gains at first, but were finally defeated and pushed across the line Constanza-Carnavoda. On Oct 28 the Bulgars reached Ostrovo on the Danube. But before that happened Mackensen had crossed the Danube during the night of the 22d near Sistova, in the rear of the Rumanian lines. He immediately constructed four bridges, and by Oct 24 his main army stood in Wallachia. He moved up the Vede River and took Alexandria. The Rumanian army command collected all available forces near Bucharest, determined to attack Mackensen who was approaching the lower Arges River, while the reorganized First Rumanian Army was concentrated on the upper Arges River northeast of Bucharest.

On Nov 30 Falkenhayn's army was put under the supreme command of Mackensen. The Rumanians were decisively defeated at the Arges River on Dec 3, and the Russians by the Bulgarians south of Bucharest. The defenders were forced to retreat behind the Ploesti-Bucharest line and the capital with its thirty-six defending forts was surrendered without attempting any resistance. Meanwhile the first division, which had occupied Orsova early in the campaign, had tried to reach the Alt River but was surrounded and captured on Dec 5.

The Russian forces in the Dobruja had been increased to five divisions but this help came too late. The entire Dobruja was lost and the Rumanian army had to be completely withdrawn from the theater of war and reorganized behind the Russian lines. It was not ready to attempt the reconquest of Wallachia and Dobruja when the Russians started a new offensive in Galicia on July 1, 1917.

["Resumé of the Rumanian Campaign of 1917." By Major Ewing. *Memorial del Ejercito de Chile*, Aug, '17. 2700 words. Four sketches.]

In initiating the campaign against Rumania, the Central Powers had the following objectives:

A. To protect Hungary and Bulgaria by stopping the Rumanian advance against these countries.

B. To destroy the Rumanian Army.

C. To protect and facilitate the communications with the Turkish and Bulgarian Allies.

D. To utilize the abundant resources of all kinds that were to be found in Rumania.

The development of the operations not only stopped the invasion of Hungary, but also impeded all operations in Bulgaria. According to Russian publications the Rumanians lost more than two-thirds of their army and practically all of their artillery.

With reference to the communications between the Central Powers and Bulgaria and Turkey, the former were able to secure absolutely the principal railway line and open new lines of communication. In addition to the railway line Belgrade-Nish-Sofia-Constantinople, they were able to open the following three lines:

(a) From Hermanstadt to Corabia on the Danube.
(b) From Kronstadt to Ploechti and Bucharest.
(c) From Bukovina to Galatz and Bucharest.

In this way the communications were practically quadrupled; also the Danube was thrown open thruout its entire length, thus enabling the Central Powers to transport millions of tons of supplies from the Black Sea to the Baltic. With reference to foodstuffs, the statistics of 1912 showed that in Rumania were 2,984,648 cattle, 7,954,864 sheep, 984,327 horses, and 2,100,672 swine. The production of petroleum in 1913 amounted to more than 1,885,384 tons.

Thanks to the brilliant tactical and strategic cooperation, the German troops and their Allies attained a splendid triumph in a campaign of a hundred days. This campaign was not only a great success from the military and economic point of view, but it also had a vast moral and political influence. It enabled Germany and Austria to recuperate their influence and prestige in the Balkans, which had been materially weakened by the entry of Rumania into the war.

At the same time, this campaign demonstrated anew the military potentiality of Germany at the very moment when her adversaries announced the downfall of her defensive forces.

SOUTHERN THEATER

[A Study of the Operations of the Italian Forces, 1915-1916. By General Malleterre. *Revue des Deux Mondes,* Oct 1, '16. 8000 words. Map.]

To obtain a satisfactory understanding of the Italian operations, a study of the line of the Austro-Italian frontier is necessary. Such a study reveals Italian statecraft as well as Italian strategy.

After Italy had by the sword gained her national unity, Austria was forced to withdraw from Lombardy and Venetia, over which she had long held sway; but she succeeded in imposing upon the young kingdom boundaries which were not only unnatural so far as Italy's nationality was concerned, but were markedly favorable for any future offensive operations that Austria might undertake against her.

Austria retained Trent, a part of Friuli and Istria, with Trieste. She held nearly all of the important mountain passes and high valleys. An Austrian offensive could be hurled thru short defiles into the heart of Lombardy or Venetia; whereas the Italians would have to cross all the country of the Alps before reaching any essential strategic objectives.

As stated by Mazzini, the limits indispensable to Italy's security include the Julian Alps, the Carnic Alps, Istria, the high Friuli country and the region of Trent.

Barzilai described Trent as a great wedge driven into the vitals of Lombardy and Venetia. Austria made it into an immense armed camp, a formidable base of operations.

On the East the Italians, if on the defensive, would have to withdraw behind the Tagliamento. The Julian Alps and the high country beyond the Isonzo, afford remarkable opportunities to the Austrians for the concentration of forces under concealment, while permitting observation of Italian movements.

Istria, with its peculiar coast lines, is of supreme maritime importance.

Upon entering the war, Italy realized that she could not, from the nature of things, count upon assistance (from the other Allies) in the nature of troops. The plan of operations shows the two-fold preoccupation: prudence and economy in the use of her mobilized forces; boldness and tenacity in her offensive upon the frontier.

The first consideration involved seizing all the passages and dominant points along the frontier, and forestalling any Austrian offensive against Lombardy in Venetia.

In mountainous country, the terrain is a terrible obstacle to operations; but improvements in means of locomotion have materially aided in overcoming difficulties of bringing up troops and heavy artillery.

A large part of the high mountain regions is inaccessible at all times. Operations concentrate in the valleys and on certain commanding points, which dominate valleys and passages, The possession of passes is the tactical objective; the openings into wide, low valleys containing roads and cultivation, the strategic objective. The two objectives constantly overlap and intermingle in the development of the combats.

Combats are often of necessity isolated in valleys and passes, until columns can unite in the long longitudinal valleys found in certain districts. Contact between columns in such cases can be kept up only by Alpine detachments.

Railroads are now climbing to the highest valleys, and heavy artillery is being placed on points hitherto considered impossible. The increased range of the artillery enables explosive shells to be hurled over crests at unexpected angles and distances.

The Italian operations began May 24th, 1915, along the whole frontier. The Alpine Italians, who thoroly knew their country, quickly gained possession of the passes from the Tonale pass to the Isonzo front. The armies probably concentrated between Verona and Udine. The railroad joining Milan, Venice, and Udine marks the front of attack, as well as the front of defense. The first care of the supreme command was therefore to cover this vitally important line of communications by throwing immediately his advance guards and outposts as far as possible across the frontier. The first communiqués therefore announce simultaneous engagements in Trent, in the Dolomite Alps, in the Carnic Alps, and on the Isonzo.

After the first successes due to the suddenness and impetuosity of the Alpine Italians, their forces found before them the powerful defensive organization of the Austrians.

The fighting is general, but it assumes more and more the character of mountain combat. The powerful works at Trent and Rovereto check the Italians. The Austrians make counter attacks, indicating the presence of troops in force. Siege warfare begins. The Italian attack seems to concentrate on Gorizia, but is driven against the entire line of the Isonzo, showing itself especially bitter toward the Carso plateau.

The Carso bars the road to Trieste, the lungs by means of which Austria draws her breath. This Carso plateau is geologically famous, a chaos of stones, irregular ledges, strange, disordered masses, torn by countless fissures and chasms. Over this terrible desert of stone a wind of the most terrific violence is always blowing. It is easy to see what a defense the Austrians have been able to organize in this place.

The Italians fought bitterly on all sectors in 1915, but the year came to its close without yielding them any of their important objectives, Rovereto, Trent, Toblach, Tarvis, Tolmino, Gorizia, Trieste. They had, at the price of great efforts made gains on the various crests and in the valleys. They had occupied Durazzo and Vallona.

They did not remain inactive during the winter. Neither they nor the Austrians ceased fighting in the midst of snow and glaciers, at incredible altitudes; and these combats will become historical.

A tremendous Austrian offensive was launched early in May, 1916, between the Adige and Brenta. The first shock was so violent that the Italians were forced to evacuate, after a superb resistance, their advanced

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positions at Pasubio, Monte-Maggio, and in the high Astico Valley. Their resistance proved invincible on the crests of Cogolo and Cengio. The Austrian attack had passed its zenith by the latter part of June, without reaching the plains. The Italian counter-attacks began to make themselves felt. The battle of Trent will be counted in the annals of both armies.

At the end of July the Italian attack along the Isonzo and against the Carso plateau resumed its former violence.

Gorizia was taken by a violent effort beginning Aug 6th and lasting till the 9th.

The attack against the Carso plateau, the key to Trieste, is continuing under the direction of the Duke of Aosta, a cousin of the King.

[Italy's Great Record. By Lewis Freeman. *Land and Water,* Sept 6, '17. 4600 words.]

One of the most important of the several factors contributing to the success of the latest and most brilliant of the Italian blows upon her Isonzo or Julian front was its comparative unexpectedness.

This does not imply that the offensive itself was unexpected but only that the opening blow came much farther north than the enemy must have looked for it.

The Italian General Staff appear to be fairly well agreed that the chances of a successful offensive are much better upon the Isonzo front than upon any other part of the line, which serpentines among the peaks and valleys of the high Alps. The consequence has been the gradual settling of the whole Alpine front into a state of what might be called "active defense" and the steady concentration of pressure on the less mountainous region along the upper and beyond the lower Isonzo.

General Cadorna has realized from the outset that the principal safeguard against attack on the Alpine front is the strength of the armies on the Isonzo.

Since Gorizia was taken in August, 1916, the Austrians have been kept so busy on the Isonzo that they have never been able to make an offensive on the Trentino or anywhere else.

General Cadorna's objectives have been variously stated by military correspondents as everything between a march around the Adriatic to Durazzo, via Trieste and Pola, on the one hand, and an advance upon Vienna on the other. Broadly stated, the Italian Commander-in-chief's objectives are precisely similar to those of Petain, Haig or Hindenburg, namely, to capture or kill as many of the enemy as possible, and, more or less incidentally, to occupy as much of the enemy's country as possible.

Considering the nature of the ground being fought over, the astonishing perseverence of the Italian attacks is more remarkable than the large area of territory conquered and the large captures of prisoners. From 25,000 to 30,000 prisoners, and a six to eight mile advance on a fifteen mile front combine to make a success rather more striking than has yet fallen to any of the Western Allies at any point between the North Sea and the Adriatic.

SOUTHEASTERN THEATER

[The Military Situation. By T. Miller Maguire, LL.D. *The Canadian Military Gazette,* Dec 26, '16. 1000 words.]

Greece is experiencing the fate of all weak nations in stirring times and has had to submit to sea supremacy. The French Admiral has put an end to its diplomatic independence by ordering the representatives of the Central Powers to leave, and now controls its military independence by forbidding any further expansion of its armed strength.

Rumania's position, which depended on the readiness of Russia for prompt assistance, is seriouslv threatened by the Central Powers. The wealth, agricultural produce and strategic positions of the Dobrudja, stretching along the Black Sea, and of Wallachia, which embraces rich and fertile territory, and of Moldavia, which commands Eastern Transylvania, were a great temptation to the Central Powers. Rumania's adherence to Russia covered the left flank of the Russian front and furthered the development of Brussiloff's plan against Hungary. But Russia could not assist Rumania to oppose Falkenhayn who forced the Vulkan and Predeal Passes while von Mackensen raided the Dobrudja. The Predeal Pass, only 80 miles from Bucharest, and the capture of the Roten Turm and Vulkan Passes, which are within 100 miles of Craiova, were likely to prove great assets to the Central Powers. Since last September, the fate of Rumania has depended upon whether or not Russia could play an important part in these districts.

The Central Powers realized all of these points and von Mackensen was called upon to solve them before Russia came to the rescue. The passes were seized, Craiova occupied, and the reserve of Wallachian grain and other supplies either captured or destroyed. This stroke counterbalances the victory at Monastir.

As in the Polish campaign of 1915, the Teuton has been far too ready and, in initiative, too prompt for the Slav, and Russia's power, tho immense, could not save either Warsaw or Craiova from the foe.

[The Turkish Retreat. By Hilaire Belloc. *Land and Water,* Apr 12, '17. 1200 words. 2 sketches.]

The escape of the two Turkish divisions which had been sent up into Persia from the base ot Bagdad after the capture of Kut last year is now certain. The pursuing Russians were held by a small rear guard at Pia-Tak Pass, the crest between the heads of the Karind and Alwand valleys, over which the road Karind to Khanikin passes. This pass is admirably adapted for a rear guard action of this nature, especially against a relatively small force, as its flanks cannot be turned save by a very wide sweep thru difficult mountains. The advance of the British force which General Maude had sent up the Diala river to intercept the Turks was stopped by a Turkish flank guard which held the British at the narrow pass thru the Hamrin Ridge just northeast of Mensurie until the Turks threw a pontoon bridge over the Diala and effected their escape towards Kara-Tepe and Kifri. When the British detachment which had been held in

front of the Hamrin Hills was able to advance up the Diala, and the Russians on their side free to come down south to effect a junction, it was found that the whole body of the Turks had escaped. It was not possible with the number of men that could be spared from the main Bagdad army to force the Hamrin positions, nor could the weak Russian force hope to carry the Pia-Turk against the rear guard the Turks had left there. The enemy's operation was clearly conducted according to plan and carried out in detail as he had expected.

The Caucasus

[A Diary from the Caucasus. By A. T. *Voenny Sbornik,* Apr, '17. 5200 words.]

The end of 1915 passed quietly on the front of our (Russian) lines in Asia Minor. Only on Dec 20 was there some slight fighting in the southwest of Olti, which resulted in our occupying some hundreds of yards of Turkish trenches near Akka.

In the meantime changes had occurred on the Persian front. While at first the object of Russian interference in Persia had been to suppress agitation started by Turco-German agents, this had been accomplished by the occupation of Teheran, and this done the mission of the Russian forces in Persia was now changed, and they received a new directive, viz., to occupy Kum, and to seize and hold the lines of communication between Turkey and Persia. For accomplishing this task two Russian columns were sent out: one southwest towards Kamandan, and the other southeast towards Kum. The first column started in the first part of December, 1915, and defeated a Turco-German detachment, reenforced by some thousands of Persian gendarmes, and provided with both artillery and machine guns. Soon afterward Kamandan was occupied, but as this town was an important road center the enemy soon attacked us at this point with a large force, but was defeated. Only small fights occurred thereafter till the close of the year.

The second Russian column reached Kum on Dec 20, after having dispersed some 600 Persian gendarmes. With the occupation of this town, Teheran was isolated from direct connection with Turkey, and the mission of the Russian forces had been successfully accomplished.

At the beginning of 1916 a new plan of operations was adopted for us in Asia Minor. This plan was briefly to make a demonstration in the vicinity of Olti, with a view of drawing the Turkish reserves towards that point, and then to attack and break the enemy's center near the Chaker-baba hill. The engagement was started on the morning of Jan 10, with varying success, but two days later the Russian forces made a general attack all along the line, which notwithstanding strenuous resistance from the Turkish army, was everywhere successful, the main Turkish position being captured together with a large booty of arms and munitions. As a result of this battle the Turks commenced a general retreat along a front of some 65 miles.

Altho there were opportunities for the Turks resisting our further advance, no such resistance was made, and our troops, advancing in several columns on Erzerum, occupied Hassan Kale and Keuprikoi, while a second advance was made further to the south by other of our forces down the Murad Chad with Melazgerd as an objective, with a view of isolating Erzerum from this direction. In this advance quantities of abandoned valuable Turkish stores, such as artillery, munitions, telephone material, etc., were taken by the Russians.

Operations were now commenced to invest and capture Erzerum, to which place the Turks had fallen back and which they were now defending. Strong opposition was met in taking hills and towns east and north of Erzerum, much more than was encountered towards the south. But, little by little, the Turkish defense was broken down, and altho there was delay due to difficulty in bringing up stores over icy roads, our investment made continual progress.

Erzerum is a town defended by a double line of forts situated on high hills; the inner line being so placed as to fire on the flanks of the forts in the front line, as well as to cover the intervals in the outer line. The Russian plan was to pierce the outer line on the north, and then to attack the inner line from this point. Other forts were then to be attacked from their rear.

The attack was commenced before daylight of Feb 12. Heavy fighting took place, but by 2:20 p. m. on this date the Karaubek fort had been captured with large quantities of booty. This success was improved on the succeeding day, by the occupation of a height to the southwest of Karaubek, and some villages in the vicinity. During this time all the Turkish forts fired continuously, but notwithstanding, our forces made some considerable gains opposite the Turkish center.

At 11 a. m., Feb 14, a new attack was started in the north against the Taft fort. By 7 p. m. the fort had been taken together with 2000 prisoners, including a regimental and two battalion commanders, and some 20 cannon. During the next day attack was made on the center of the outer line of forts, by enveloping attacks. Altho much hampered by snow, severe cold and the Turkish resistance, the entire outer line was captured, the enemy retreating to their inner line. The attack was at once carried to the inner line, which was first pierced at 3 a. m. on Feb 16, and by a. m. Russian troops were in Erzerum itself.

The defeated Turks retired in three directions, towards Charput, towards Erzingan and towards Baiburt. Russian columns were at once sent in pursuit, and a considerable number of prisoners and guns were captured. The total number of guns taken at Erzerum was 249.

(The principal point to notice in this article is the sustained attack made by the Russians on Erzerum, giving the enemy no opportunity to alter his dispositions. The snow and cold affected both sides alike, but it can be assumed that the Russian dispositions made in advance were suitable for their intended attack, and the Turkish dispositions more or less unsuitable. By attacking all along the line, the weather

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conditions undoubtedly were an advantage to the Russians, in concealing their movements and preventing rapid changes in the dispositions of the Turks. It is unfortunate that the author failed to give the strength of the opposing forces in this campaign.—Ed.)

The Dardanelles

See also
Dardanelles, Operations at the (1915)

Egypt

[Defeat of the Senussi. *Army & Navy Gazette*, Feb 17, '17. 200 words.]

The British War Office announces that the operations against the Senussi in the western desert of Egypt have been brought to a successful conclusion in a battle near Girba where the Senussi were routed and scattered.

Mesopotamia

See also
Kut-el-Amara, Battle of

[Operations in Mesopotamia Up to the Surrender of Kut-el-Amara. *La Guerra y su Preparación*, Madrid, Aug, '16. Sketches and editorial notes. 7500 words.]

(This paper describes in detail the hardships suffered by the English and Indian troops in the Mesopotamia campaign, and the events leading up to surrender.)

The few roads in the interior were hardly more than paths or caravan trails, and were followed with great difficulty by those unaccustomed to them. General Townshend's first objective was Basora, but his advance was slow, due not so much to Turkish resistance as to the nature of the country thru which he had to pass. This was very swampy and cut by canals and ditches. Whole weeks were spent in preparing a system of supply which included the use of horses, pack-mules, camels and rafts. After taking Basora and Korna, he endeavored to continue his advance along the banks of the Tigris river, but the Turks not only halted the advance, but actually retook Korna and held it for some time. Summer, with its terrific heat, converted the mud into fine dust which was even worse than the mud. During the enforced halt of the British, they were continually attacked, but the mosquitos did them more harm than bullets. In the middle of September, the English moved forward again and drove back the Turks as far as Kut-el-Amara, where they halted and organized themselves well on the defensive. With the arrival of autumn the English general faced this dilemma: he must at once continue his advance with fatigued and greatly diminished force, or wait indefinitely for reinforcements; as he had already advanced more than 250 miles into the enemy's territory and did not wish to lose the advantages thus gained he chose the former plan, first fortifying Kut-el-Amara. On Nov 3, he was about 20 miles from Bagdad. German reinforcements, 75,000 rifles, commanded by Gen. von der Goltz arrived as the English were driving the enemy from his positions of Ctesiphon. General Townshend, four or five times outnumbered, began an orderly retreat to his fortified position at Kut-el-Amara, arriving there Dec 15. He hoped to hold out there until the arrival of the much needed reinforcements. Gen. von der Goltz at once laid siege to Kut-el-Amara, planning to cause a surrender by preventing the arrival of aid, and maintaining a constant attack upon the English positions. Everything seemed to combine against General Townshend. Not only was his army almost entirely lacking in food and medical supplies, but the rapid melting of the snows produced an overflow of the Tigris which inundated a part of his position. This inundation not only threatened his own defenses but actually put in danger the army which was coming to his assistance. He ordered the evacuation of the town by the civil population in order to conserve his food supply but in spite of every effort and after four months of this unequal siege warfare, was finally forced to surrender on April 29.

[Mesopotamia and the Dardenelles. By Lt.-Col. L. *Rev. Mil. Suisse*, Nov, '16. 4150 words. Map.]

[The following abstract treats of Mesopotamia only.]

If the defeat of the Marne can be attributed in a large measure to German arrogance, it is only justice to attribute to British arrogance those two grave checks to the Allied cause, Gallipoli and Kut-el-Amara.

The British have always affected a profound disdain for the Turkish army, a disdain which their defeats at the Dardanelles and on the Tigris have given them cause to repent. The failure of both expeditions is clearly due to a lack of preparation, which in its turn, was due to ignorance of the enemy's resources.

The responsibility for these checks does not fall on the English troops nor on their immediate chiefs, who have performed prodigies of energy and valor. It belongs to the English people themselves which has neglected its military institutions for centuries, and on the government, ignorant of everything concerning war. English military journals, while observing a certain reserve, clearly give this impression.

* * * *

It is not probable that the Mesopotamian expedition was originally directed against Bagdad, but rather, in the event of a rupture with Turkey, to protect the English population of Bassorah and the great oil refinery of Abbadan, situated on Persian territory near the mouth of the Shatt-el-Arab.

The 6th brigade, of the Indian army, under the command of General Delamain, had been concentrated towards the end of October, 1914, in the archipelago of Bahrain in the Persian Gulf. War having been declared Oct 31st, this brigade, which had not left its transports, was immediately directed to the mouth of the Shatt-el-Arab. At this time there were three Turkish divisions in the north of Mesopotamia and one in the south. The strength of the latter was, at least, 8000 rifles and 32 guns, while the English brigade had only 3800 rifles and 2 mountain batteries. One wonders whether to admire the intrepidity of those who dared to undertake the conquest of Mesopotamia with such a small force, or to be astonished at the lack of foresight and the ineptness of those who sent it there.

On Nov 6 an English detachment disembarked at the mouth of the Shatt-el-Arab and seized the little fort of Fao. The main body of the brigade went up the river by boat and reached Abbadan on the 8th. (Just below the junction of the Karum and the combined Tigris and Euphrates.—Ed.)

On the 14th, Major General Barrett arrived and took command. He brought with him the 18th brigade, 3 batteries, 2 squadrons, and 2 companies of sappers.

After fighting, at Sahain and Sahil, the British occupied Bassorah on the 22d.

The original object of the expedition was thus attained in less than 3 weeks. It would seem to have been good policy not to push further before becoming solidly established at Bassorah, which is more than 100 kilometers from the coast. During the first months, the English did proceed with prudence but later became more ambitious, as will be seen. There were small expeditions to Kurna and Rotah, but nothing of importance until the Turkish attack of Bassorah on the 11th of April. By this time, the English forces had been increased to 5 brigades, or about 25,000 men. The Turks were probably a little stronger. The battle lasted till the evening of the 14th, when the Turks retreated about 150 kilometers up the Euphrates. During the fight, the mirage effects were so great that, at times, the combatants could not see each other, even at short distances.

According to an English officer, a little less inertia on the part of the Turks would have enabled them to acommplish their purpose. In the middle of February, they had twice as many troops only two days' march away.

With Bassorah out of danger, General Gorringe was sent with a division to drive the Turks out of the Persian valley of Karun, which they had occupied early in the year. This was accomplished, and a brigade was marched from Ahwaz on Amara where strong Turkish forces were reported. At the same time, the 6th division, commanded by General Townshend, was started up the Tigris against Amara. For the first time the British had aeroplanes. On the morning of June 1st, these reported that the enemy was retreating. Townshend, preceding his troops on a fast boat, arrived at Amara, accompanied by only 22 men, and made prisoners 700 Turkish regulars, firemen from Constantinople. The main body reached Amara the following day and was joined on the 18th by the brigade that had marched from Ahwaz across the desert.

At the end of June, General Gorringe, back from his Karun expedition, went up the Euphrates, marching on Nasiriyeh, at the junction of the Shatt-el-Hai and the Euphrates. He seized it on July 25th, after 3 weeks of hard fighting, completing thus the conquest of southern Mesopotamia.

Evidently, these operations were necessary to assure the safety of Bassorah. They had, besides, been conducted methodically and without haste. It would certainly have been preferable to push no farther for the time. Amara and Nasiriyeh are at about 300 kilometers from the coast, not even half-way to Bagdad. It would seem that, at the time of the capture of Nasiriyeh, pushing as far as Bagdad had not been thought of.

Did the English allow themselves to be intoxicated by their easy successes, like the Germans in 1914? Were their information and reconnaissance services deficient? Probably, for a few weeks after the taking of Nasiriyeh, we see an English column starting for Kut-el-Amara, about 150 kilometers further in the interior.

The Townshend expedition was composed of 4 brigades with artillery, cavalry and sappers, probably between 15,000 and 20,000 in all. The English arrived before Es-Sinn, 10 kilometers east of Kut-el-Amara on Sept 27th. The Turkish position had a front of 11 miles, 4 on the right bank of the Tigris and 7 on the left bank. Both flanks rested on marshes. The position was well fortified and covered by strong barbed-wire entanglements. Subterranean shelters were numerous and the trenches well dissimulated. English aerial reconnaissance could not determine the enemy's strength nor locate exactly the left flank.

When stopped at 8 kilometers from Es-Sinn, there was one English brigade on the left bank with three on the right bank. During the night, Townshend threw across a bridge of boats and brought 2 brigades over on the left bank. These he caused to march to his extreme right and, in the morning, they emerged from the marshes almost in rear of the Turkish left wing which appears to have been taken by surprise. Turkish reserves, arriving directly from Bagdad, fell in their turn on the English flank and the fight was undecided for quite a while. Finally the Turks retreated leaving some 1500 prisoners, 8 guns and 4 machine guns. On the 29th the English occupied Kut-el-Amara.

The English were too exhausted to pursue, and an Arab raid had destroyed the train, including the coal for the supporting flotilla of gunboats. Perhaps an energetic pursuit at this time would have succeeded in reaching Bagdad before the arrival of Turkish reinforcements.

On Oct 6th, the English advance guard stopped at Azizieh, 80 kilometers from Bagdad. One may wonder again if it would not have been preferable to stay there. The attack on Bagdad, surprise now being out of the question, should have been seriously organized, not only for the attack itself but for further operations. If Townshend had waited for the troops that later wore themselves out in a vain attempt to rescue him, Bagdad would probably now be English. With the forces at his disposal, success was practically impossible.

On the 22d of October, 1915, Townshend attacked Ctesiphon, almost under the walls of Bagdad, and carried the Turkish first line, but he was vigorously counter-attacked and did not succeed in breaking thru; on the 26th, he was obliged to retreat.

On Dec 7th, Townshend returned to Kut-el-Amara and was soon invested by the Turks. The Bagdad expedition, undertaken with insufficient means, had failed pitifully, in spite of the valor of the troops and the energy of the leaders.

The relief expedition, organized in haste, was not destined to have any more success. A column com-

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manded by General Aylmer succeeded, on Jan 6th, in reaching a point 25 miles east of Kut-el-Amara. It defeated a Turkish detachment there but could not push much farther. It was finally in April decisively stopped before the Turkish positions of Es-Sinn and Sanniyat.

Another column, which tried to go up the Euphrates, was equally unsuccessful.

It is just to say that these operations were much hindered by the floods. It seems, however, that with more foresight sufficient means might have been assembled, in five months, to relieve Townshend or, at least, to supply him.

Townshend, abandoned to his own resources, defended himself energetically, repulsed all Turkish attacks and yielded only to hunger. An attempt to supply him by a blockade-running steamer having failed, he had to surrender unconditionally on April 30th, 1916, with 9000 men. The Turks sent back the sick and wounded to the English; the others have not been heard of since.

Thus ended, after a heroic struggle of 18 months, an enterprise ill-conceived and badly managed by politician and cabinet strategists.

(To be continued.)

[Forces in Mesopotamia. *Army and Navy Gazette*, June 23, '17. 200 words.]

The general health of the British forces in Mesopotamia is good. The admission rate is less than double the Indian peace figures, and the death rate, 4.5 per 1000 per annum, is only slightly higher than the Indian peace rate.

Arrangements have been made for local growing of crops, and full and varied supplies of vegetables can now be obtained thruout the year at all the principal centers.

[The Mesopotamia Report. Editorial. *Army and Navy Gazette*, June 30, '17. 1800 words.]

The Mesopotamian report has been published and it possesses certain points of unflattering similarity to the Dardanelles report. In both cases operations of far-reaching character were undertaken without sufficient thought of all that they might lead to. The Mesopotamia report is a distressing and humiliating document. The Indian force was insufficiently equipped, having suffered for some years past on account of grinding economies. These had been effected at the cost of efficiency. Guns had been cut down in numbers, and heavy ordnance and howitzers were lacking. The economies even extended to the establishments and equipment of the military hospitals.

"The report shows in merciless clarity the mistakes that were made—and not remedied thru months of warfare; the want of transport, the absence of railways, the wholly preventable hardship and suffering inflicted on the wounded." Blame is apportioned. Out of this experience perhaps the Indian Army may emerge a really effective instrument for modern war.

[The Findings of the Mesopotamia Commission. Notes by Edward Foord. *Sphere*, July 7, '17. 3000 words. Illustrated.]

The Commission says that "the expedition to Mesopotamia was a justifiable military enterprise," but it was of such a character that it "required during its inception and development the most careful watching and preparation."

Preparation and supervision were conspicuous by their absence. Economy and efficiency are not incompatible, but in the Indian Army economy had undermined efficiency. *In the spring of 1916*, there was a deficiency of many necessary articles, even of blankets and clothing. The ill-organized Turkish forces operating against us were actually better equipped 18 months after the outbreak of war.

There was grievous lack of co-ordination. Requests for more transport and supplies were refused or inordinately delayed, mostly on the ground of expense. Officers who attempted to protest were silenced in a manner that amounted to terrorization. Gen. Duff ignored lack of medical supplies and shortage of transport, and made light of warning that Marshal von der Goltz was in full march on Bagdad. Whitehall and Simla did not pull together until the summer of 1916, when the War Office took full control.

The expeditionary force was miserably equipped. There was not enough artillery and what there was was obsolete; there were about half the necessary number of ambulances and hospitals, and they inadequately staffed and supplied; there were no double tents to protect against the burning Mesopotamian sun; there were deficiencies in clothing; rationing was inadequate, causing scurvy among the soldiers; and worst of all, there was no proper transport. A light railway was suggested as a means of transportation, and after three months delay it was denied on account of expense. There were no wharves at Basra, and no facilities for loading or unloading, or for repair. The Commission sums up: ". . . the want of foresight and provision for the most fundamental needs of the expedition reflects discredit upon the organizing aptitude of all the authorities concerned."

The worst horrors of the campaign were due to inadequacy and breakdown of the medical service. There were no electric fans to ventilate the hospital buildings, no ice plant, few mosquito bars despite the plague of flies, and no appliances for purifying water. Little was done to remedy these deficiencies, and when matters were at their worst (December, 1915) medical aid offered from Britain was refused. An account of the state of the wounded on the Medjidieh for sheer horror "equals anything we have read in military history."

A victory was needed to counter the German successes in Serbia, so Gen. Townshend was ordered forward. Reinforcements of two divisions had been promised but were not forthcoming. Gen. Townshend was under no illusions. His force was insufficient, his artillery inadequate, and his line of communications long. His men were over-worked and dispirited.

The conclusions of the Commission apportion the blame for the failure.

[The Battle of Ramadie. By Hilaire Belloc. *Land and Water,* Oct 11, '17. 280 words. 1 sketch.]

Sir Stanley Maude's very complete success at Ramadie on the Euphrates on Sept 27 resulted in the capture of 3310 men and 145 officers with 13 guns and much other material. An interesting point in the account of this engagement is the mention of railway material and of "several miles of line." This suggests the completion of a railway down the Euphrates valley of which the public has as yet heard nothing.

Palestine

[The Operation Before Gaza. By Hilaire Belloc. *Land and Water,* April 5, '17. 900 words. 1 sketch.]

Gaza is just to the north of the river of that name. It stands on a hill about 100 ft. high and is on the edge of the desert about 3 miles from the Mediterranean Sea.

The British determined to seize the river mouth and crossing in order to cover the advance of the railway now being constructed from the Egyptian base to supply the British force to be used against the Turks in Syria. This operation took place on March 26th. The river was not defended, but a Turkish force under a German commander occupied a position between the river and the town itself. This force was defeated and withdrew after a loss amounting to 8000 men, including a division commander and staff.

Total British losses in killed were 400. The interest of the operation lies in the fact that it shows how far the railway has advanced and what a threat is now directed against the railway to Beersheba from the north. Beersheba was the enemy's railhead and principal base for his attacks on the Suez Canal.

Salonika Front

[The Occupation of Monastir. By Hilaire Belloc *Land and Water,* Nov 23, '16. 5800 words. 4 sketches.]

Monastir was occupied by the Allied troops on Nov 19th. Gen. Sarrail had the advantage of acting from a base whence communications radiated east towards the Struma front by road, northward towards Lake Doiran by road and railway, and westward towards Monastir, by road and railway. He thus held a convex front from the lower Struma to Lake Doiran and so round to the neighborhood of Lake Ostrovo. The English were charged with the right, towards the Struma; the English, French and certain Serbian contingents, with the center towards Lake Doiran; the Serbians, the mass of the French forces, and the Russians, with the left, or northwestern sector facing towards Monastir. The Allies could thus strike at will upon any part of this front, and concentrate upon the part chosen with more rapidity than could the opponents, who possessed no good lateral communications. The Allies took the offensive on Sept 11. The movements of the first month consisted in the advance upon Monastir, coupled with holding operations upon the center and right, that is upon the Vardar Valley, and the Struma. This phase ended on Oct 14th, when the advance was checked by the lines of Kenali which crossed the mouth of the Monastir plain and covered the city at an average distance of from eight to ten miles. The second phase of the operations occupied one month, and consisted in the turning of the Kenali lines by an attack across the great bend of the Cerna River. The attack culminated successfully on Nov 14, and resulted in the fall of Monastir. (A detailed tactical description of the advance as effected day by day is given.)

FAR EASTERN THEATER

[The Colonial Campaign by the Allies. Accounts given to Col. Echagüe, by the French General Staff. *La Guerra y Su Preparación,* Madrid, Jan, '17. Conclusion. 2500 words. Maps.]

The Occupation of Tsing-Tao

On Aug 14, 1914, Japan delivered an ultimatum to Germany demanding that the territory of Kiao-Tcheou be restored to China, and gave the Germans until Aug 24 to reply. On Aug 24, Japan declared war notifying Germany on the 27th of the blockade which lasted from that date until Nov 10.

Dispositions of Japan's Naval Forces

The first squadron was to patrol the waters to the north of Shanghai; the second, the route between Shanghai, Hongkong and Singapore, while the third was charged with blockading Tsing-Tao. This last squadron comprised (in addition to the English battleship *Triumph*) three ships, two coast guard cruisers, three armored cruisers of the first class, nine cruisers, twenty torpedo boat destroyers and a fleet of mine sweepers. It was organized into four naval divisions and one flotilla of torpedo boat destroyers.

Military Measures Taken by Japan

The Japanese Government decided on an army of 50,000 men, 150 guns and about 10,000 horses, this force assisted by one battalion of Angalis and half a battalion of Indian troops commanded by Brig.-Gen. Barnardiston. Operations were begun by airplanes throwing 120 bombs on Tsing-Tao without important results.

Military Measures Taken by the Germans

On the morning of Aug 15 the Germans began the work of fortification. The works of the defense consisted of six forts armed with field guns of varying calibers, namely, the forts of Bismarckberg, Hui-Tschuen-Huk, Ilsi-Aushi-Wan, Iltisberg, and of the batteries of Iltis Tsing-Tao (Yamen), redoubts and infantry works. The strength of the garrison was about 5000 men.

On Sept 2 the Japanese disembarked in three successive lines in the bay of Lung-Kou (Gulf of Pe-Chi-Li). While the navy was engaged in mine sweeping 28,000 Japanese soldiers attacked the heights of Tsang-Ku, situated between the Pai-Sa and the Li-Tsum rivers. The Germans evacuated the position Sept 27. The water front of Tsing-Tao was bombarded by the Japanese naval squadron and the Ger-

EUROPEAN WAR—Continued

mans also gave up the positions nearest Li-Tsum, Walderseehohen and Prince Heinrichberg. On Sept 29 a detachment of the Japanese naval brigade took possession of a port in the bay of Tanschan; on Oct 14 the Germans sank two Hamburg-American boats in the mouth of the harbor to protect its entrance and the torpedo boat *S. G. O.* slipped out of Tsing-Tao and sank the Japanese cruiser *Takachito*.

On Nov 7, after a terrific bombardment which lasted all night, redoubt No. 3 was taken by assault, the garrisons of the other infantry works then surrendering. At 6 in the morning the Germans blew up several of their forts and batteries. The surrender took place on the same day.

The War in New Guinea and the Marshall Islands

At the outbreak of war Germany had various colonies to the north of Australia: Emperor William's Land, Bismarck Islands, Samoa and the Caroline Islands. Emperor William's Land, in the northwest of English New Guinea, has an area of 179,000 square kilometers with a population of 340,000 natives and 239 whites, of which 216 were Germans. The Bismarck Archipelago has an area of 61,000 square kilometers, the principal islands being New Pomerania, New Mecklenburg and New Hanover, with a population of 200,000 natives and 510 whites. Germany took possession of them Nov 3, 1884. They possess deposits of coal and gold.

The Caroline Islands, Palau, Marianas and Marshall, are old Spanish possessions and were bought by Germany in 1899.

Occupation of New Guinea

The Germans moved the seat of government of New Guinea to Toma in the interior of New Pomerania and organized the defense with a view to avoiding the bombardment of the important cities of Rabone and Herbertshöhe. In the defending forces there were only 50 Germans, all the others being natives.

The operations in this out-of-the-way zone of the German colonies lasted from Aug 18 to Oct 3.

An Australian fleet of four cruisers and three torpedo boats appeared before Rabone and Herbertshöhe on Aug 18 and sent ashore troops who destroyed government buildings in both cities. On the 10th of September the same fleet returned to Herbertshöhe and occupied the city without fighting. But when they marched against the wireless station of Bitakapa, beyond the city, there was hard fighting over about 7 kilometers of hilly country, in which the Germans were entrenched and had mined the roads. The wireless station was taken only after hard fighting and severe losses, when the victorious Australians advanced on Toma, where the Germans surrendered.

Occupation of the Caroline and of the Marshall Islands

The Japanese Government offered to co-operate with England for the protection of commerce in the search of enemy's ships, and on Oct 3 a Japanese squadron appeared before Joluit and occupied that place. The British cruisers *Hampshire* and *Minotaur* destroyed all communications between the islands and in both districts the German authorities surrendered without resistance.

Conquest of the Samoan Islands

Germany took possession of these islands between Nov 14, 1899, and May 1, 1900, and government headquarters were established in Apia on the island of Upola. This group has an area of 1691 square kilometers and a population of 33,478 natives and 504 whites, 284 of which are German. They do not possess a real seaport. The French and English declarations of war became known on Aug 5, and Dr. Schultz, the governor, caused all the Europeans to arm themselves in order to protect the wireless station at Tafigata. In a council of war, Aug 5, it was decided to surrender the colony without resistance in case of attack.

An English expedition, prepared in New Zealand and assisted by French and Australian ships, under command of Sir George Patey, set out for Apia. On Aug 29 the governor of Samoa, who had waited in vain for German ships, was forced to give up the islands, and on Aug 30 the British troops took formal possession of them and Col. Logan was named governor. In November, 1914, the British Government declared its intention of turning over to the Australians the German possessions in the Pacific until an Allied conference should definitely dispose of them.

[Part Taken by Japan in the Great World War. By J. I. B. *N. Y. Evening Post*, May 2, '17. 1550 words.]

Altho since the fall of Tsingtau in November, 1914, Japan's part in the war has been apparently inconspicuous, she has nevertheless done much. For example, in patrolling and guarding the waters of East Asia, the South Seas and the coasts of South America, Japan helped to drive the enemy ships into waters where the British could deal with them. Japan was of great assistance in convoying Anzac troops to Europe, at a time when the *Emden* was still at large; she captured the various South Sea possessions of Germany, and has patrolled and is still patrolling the waters east of Hong Kong, keeping watch on the various enemy ships interned in Chinese, Philippine and Dutch East Indian ports.

But Japan has done and is still doing a great deal more than this. She has steadily supplied munitions to Russia, and provisions to Russia, France and England. The value of her shipments to Russia is estimated at $200,000,000, in guns, ammunition, equipment of all kinds, including Red Cross and hospital supplies. Some 60,000 men are working day and night in the Government arsenals of Tokio and Osaka, while private factories and minor military and naval establishments are helping in the output. Japan has also made some attempt to suppress enemy trade, tho this has been a difficult matter, because so many Japanese merchants were intimately connected with German houses.

Diplomatically, a new agreement with Russia touching neutral interests in Manchuria has been of assistance to the Entente. Japan has suppressed the Chinese *ronin,* political meddlers whose end in life is to make such trouble in China as to force Japanese interference. This was a delicate task, but it has been successfully accomplished. There can be no doubt that Japan means to stand or fall with the English-speaking peoples. The Zimmermann conspiracy missed its mark in Japan; it convinced the Japanese that the German cause was desperate. Financially, Japan has helped the Allies by the purchase of bonds, and by making loans. Her attitude during the whole war means much for the future of the world's peace. It is worth while here to recall a remark made by Marquis Okuma, not to a foreigner but to a Japanese, that during his long experience with foreigners in the Government service, he always liked the Anglo-Saxons best, because they were more trustworthy tho less affable than other nationalities.

AFRICAN THEATER

[The Colonial Campaign by the Allies. Accounts Given to Col. Echagüe. By the French General Staff. *La Guerra y su Preparación,* Nov, '16. 1200 words. Maps.]

(In this article the operations in the various German South African colonies are related separately. In each case the account of the conquest of the colony is preceded by a geographical description of the country and a historical sketch of its acquisition by Germany and its development by the Germans.)

Operations in German Southwest Africa

At the outbreak of the war the German forces numbered 2000 European soldiers and it was supposed that some 3000 men could be mobilized. They immediately took the offensive by occupying, on Sept 2, the English port, Walfish Bay, and invading the territory of the Union between Nakob and Upsington on the 19th.

The garrison of South Africa numbered some 6000 men and there were in addition about 20,000 South African native troops in the expeditionary force. A part of this force was transported by sea to Luderitzbucht and, operating against the German invaders from this point, it succeeded in driving them out of Randfontein and back into their own territory.

The two German posts Ukamas and Nabac on the southeastern frontier, were taken by the English, and from this time the invasion of German territory proceeded.

The invasion was made in three columns. The first, under General Botha, operated in the north, disembarking at Swakopmund on Walfish Bay (recaptured by the English, Sept 29). This column advanced to and occupied Windhuk, the capital of the colony. The city was taken May 12 without opposition. Gen. Botha immediately continued his advance northward to the railroad at Onguat and to Grootfontein, the enemy always retiring without giving battle.

The second column, commanded by Sir Duncan Mackensie, started from Luderitz Bay and penetrated 70 miles into the interior, arriving at Karub.

The third column was commanded by Colonel Van de Venter and was called the Orange River column. It occupied Nabac, Warmbad and on the 20th of April took Kalkfontein, the southern terminal of the railroad.

The campaign may be considered to have ended July 14. The troops of the Union had suffered losses of 122 killed. They had acquired for the Union a territory three times as large as the United Kingdom, rich in mines and farm lands.

[The Campaign in Central East Africa. By Owen Letcher. *Land and Water,* May 31, '17. 2000 words.]

The East African Campaign has now lasted for almost as long as the Boer War. It is only a subsidiary enterprise, but nevertheless an important one, for with the final defeat of Col. von Lettow Vorbeck's troops the whole African continent will be freed of the last vestige of Prussian rule. Both in blood and treasure the campaign has been a costly one.

Transport in this country of vast distances has been enormously expensive, and munitions and supplies by the time they have reached the fighting columns, represent a cost greatly in excess of the original outlay.

General Northey's little army in the remote southwestern corner of German East Africa was the most costly force in the world to maintain in the field, and until the central railway was seized and repaired the forces operating from the north, under Gen. Smuts, and the Belgians under Gen. Tombeur, co-operating with the British column under Gen. Crewe, were very nearly as costly.

The campaign has been bloody, and apart from deaths and wounds, some thousands have been invalided thru malarial fever, black water fever, and dysentery. An initial error was made in not providing every man of the expeditionary forces with a mosquito net.

German East Africa is a fertile and beautiful country about 400,000 square miles in area with a population of between 7 and 8 million natives.

It has a sea-board of 450 miles, with several fine harbors and the great lakes on its western frontiers constitute what may be termed an inland sea-board.

It has two railways—one of which, the central line, cuts thru the country from Dar-es-Salaam on the Indian Ocean to Kigoma Bay, on Lake Tanganyika, a distance of 700 miles.

The country possesses mineral as well as agricultural wealth, and every type and gradation of climate, topography, and scenery.

At the time of writing (April) the rainy season is drawing to a close in that part of the territory in which the Germans are making a last desperate resistance. All the railways, ports, and chief towns are in Allied possesion.

The German commander is putting up an admirable resistance against forces superior in numbers, morale and equipment. He is short of foodstuffs and munitions. He has retired some hundreds of miles, and his black troops are disaffected. His white men, too,

EUROPEAN WAR—Continued

are tired of continuing a futile struggle. The King's African Rifles is a black force led by British officers which has played a prominent part in the campaign. With a view of bringing the campaign to a conclusion this dry season, additional white troops are now being sent forward, and it is probable that the final offensive operations will soon begin.

Camerun

The German forces numbered about 12 companies of 200 men apiece, in addition to a number of native guerillas. The Allied forces, under General Dobell, English, was made up of two columns, one English and one French. The French column, mobilized Aug 16, consisted of one company of Europeans, two battalions of Senegalese riflemen, one mountain battery and one section of engineers. The British had several thousand men, with ten mountain guns.

Operations were begun on the north, east and south borders by French troops from Tchad and Central Africa at the same time that a British-French column took up the offensive on the coast.

The expeditionary troops concentrated at various points along the neighboring coast, embarked on transports and sailed to Duala. The English cruiser had captured the German gunboat *Soden* and destroyed all German merchant ships in neighboring waters.

On the 26th of September, the challenger began a bombardment of Duala and the German garrison immediately gave up the city, retiring toward the interior.

Immediately upon occupying Duala, General Dobell started a column toward the north to prevent the enemy's operating against the Nigerian frontier. This column, consisting of 100 marines, 1½ battalions of riflemen and a battery of artillery under Col. George, moved on Jabassi, working up the Wuri River in small boats and disembarking at Nsako, 3 kilometers south of Jabassi. From Nsako the attack was made on Jabassi, but it failed, and the command was forced to fall back on Duala, arriving there Oct 10. A new attempt was made on the 14th and this time the enemy evacuated their positions and the English forces occupied Jabassi. At the same time a second column, under Lieutenant-Colonel Haywood took Susa and de Kaki on the 9th, and after receiving reinforcements, occupied Mujuka, on the railroad, driving the Germans back toward Mundame.

A third column, organized in Duala, moved on Mpun-du-Econa-Buca, while Colonel George advanced on Victoria to capture Cameron Mountain. This position was attacked from the north and south simultaneously, and was quickly taken, the enemy retreating.

On Nov 13 a company of marines landed from the French cruiser *Bruix* and the English ship *Ivy*, which had previously bombarded Victoria, occupied the seat of government, and three days later the zone Victoria-Buca-Mujuki-Jabassi was completely cleared of the enemy. This gave the Allies a base of operations. It remained only to broaden the conquered territory. To accomplish this a column composed of three battalions and two batteries advanced along the railroad from Mujuki, repulsed an enemy attack at Nloke and arrived at Nkongsamba, the railroad terminus. Baro was occupied Dec 16.

Meanwhile the French forces had moved out of Duala with Edea as objective. There were three columns. The main column arrived at Edea Oct 26. The second column arrived the same day, having fought a severe battle with the enemy found intrenched in Kopongo. The third column encountered the enemy at Lobetat, drove them off, and joined the other columns in Edea Oct 28.

The new objective was to clear the line Edea-Dehane-Longji and drive the Germans from the coast zone.

The enemy, retiring from Edea, established themselves in positions not far from the town, and the French took up the work of driving them off. This was accomplished in four separate reconnaissances which took up the months of November and December, 1914. After several small skirmishes the Germans retreated.

Meanwhile the columns operating in the North were advancing rapidly into the interior of the colony. On Jan 15, 1915, Colonel Brisset, at the head of the French column from Fort Lamy, joined the English column under Major Webb Dowen, before Garua. The two forces immediately besieged the town strongly fortified by the enemy. The garrison consisted of three companies, of 200 men each, equipped with four field pieces and several machine guns.

General Dobell, considering it of great importance to keep this force from joining the enemy main force in the South, sent reinforcements to the besieging force and ordered the English Colonel Canliff to relieve Colonel Brisset, in charge of the operations.

On June 11, after several days of the bombardment, the city capitulated and the besieging forces took up their advance, the English moving on Kontscha and the French on Pokor. These columns advanced rapidly and the enemy soon found himself hemmed in on all sides and obliged to make a final resistance in the neighborhood of Yaunde.

After a conference between the French Governor and General Dobell to co-ordinate the movements of the British troops and those from French Central Africa, two columns had been formed, the French column to advance on Yaunde, and the British to keep on their flank, advancing on Esseka.

After repeatedly driving back the enemy, these forces arrived before Yaunde, and on Jan 1, 1916, took the city, the enemy falling back toward Koolowa and Lolodorf. An active pursuit was immediately taken up, but the German Governor Ebermayer, with a large part of his force, escaped into Spanish Guinea.

The success of the Allies was complete, but the powerful defenses which the Germans had long been secretly organizing, made the campaign one of the hardest of those fought in the colonies.

German East Africa

At the beginning of the war the English sent an expedition against Tanga, but finding the defenses well organized and defended by a superior number of the enemy, they were forced to retire to Mombasa.

About Aug 1 two English ships successfully bombarded Dar-es-Salam, the capital of the colony, but in spite of this success it was considered necessary to send reinforcements. These raised the total strength of the English forces to three squadrons of cavalry, fourteen battalions of infantry, three batteries of artillery and three companies of engineers.

The German forces in East Africa were some 40,000 natives officered by about 4000 Europeans, with field pieces and machine guns.

The events of the campaign took place in five separate regions.

I.—Along the Coast About Dar-es-Salam

The English bombarded and captured Dar-es-Salam about the middle of August, 1914, after failing in a previous attempt. Tanga, a port at the head of the Usambara railroad, was also occupied by British forces.

II.—In the Southwest, Between Lakes Nyanza and Tanganika

Hostilities broke out in this zone Aug 22, 1914. The Germans bombarded Luguka, the head of the Congo railroad.

The German flotilla on Lake Tanganika attacked Luguka several times and bombarded Albertville, their various attempts to land being unsuccessful. These attacks ceased when the fire from the heavy guns at Luguka finally found the *Hedwig-von-Weinman,* Feb 2, 1915.

The German and Belgian fleets fought for control of the lake.

The Germans attacked Abercorn and Karanga but were repulsed in each case, and upon the approach of British reinforcements retired across the border.

III.—On the North and Northwest of the Anglo-German Frontier in English Territory on the East Shore of Lake Victoria

The Germans advanced into English territory with the object of cutting off the important Uganda railroad. They occupied an unimportant post on the frontier but their efforts to proceed were unsuccessful. A small force which attempted to take the railroad bridge at Voi was annihilated. On Sept 10, a force penetrated to and captured Kinii, but was dislodged by the British on the 12th, and compelled to retire on Karungu.

Some days later there was an engagement between the English fleet, the launches *Winifred* and *Kavirondo* and the German ship *Nuausa,* at Karungu, the English taking possession of the town.

IV.—The Region Northeast of Kilimandjaro

On Dec 18, 1914, the English started an advance thru the valley of the Umba with the purpose of forcing the enemy to retire beyond the frontier. The Germans had for several months occupied a considerable district in the Umba valley. On the 20th the British accomplished their object and on the 22d established themselves in strong positions on the south bank of the river. On Jan 8 the German post Sherati, on Lake Victoria, was attacked and captured with slight resistance.

By the end of April, 1915, the operations in this region had resolved themselves into a series of sanguinary skirmishes. The English penetrated into the western territory as far as Mara, while the Germans raided English territory toward Lake Mapadi and to the east of Kilimandjaro.

V.—To the Northwest of Lake Kiva

On Sept 24 the Germans took the island of Kuibjibi, which commands the lake, destroyed the frontier post and launched over the country a number of bands of savages, who burned the towns, killed the male population and carried off the women.

The invasion was promptly checked. A column was formed in Rulshura under Lieutenant-Colonel Henry, and sent out toward Lake Kiva. The native bands retreated, the Belgians pursuing them. The regular troops of the enemy were finally encountered and driven back across the border after a very stubborn fight.

The Belgian troops took the offensive May 25, 1915. They crossed the border and took Kissegnitz. During September they successfully attacked the enemy at Ruriru and also at Luvungi. The operations in this zone have proceeded very slowly. The Belgians have just sent new contingents of considerable size.

[To be concluded.]

[The Campaign in East Africa, etc. *Jour. Royal United Service Inst.,* May, '17. 8000 words. Two maps.]

German East Africa is a territory far larger than France. It is bounded on the north and southwest by British territory, on the west by Belgian Congo, on the south by Portuguese territory, and on the east by the Indian Ocean. Since Portugal entered the war, no help could reach this German colony except in rare instances from the sea. As an example of the latter, the *Königsberg* and two blockade runners reached German East Africa.

The lowlands near the coast and the river valleys are unhealthful, but the interior plateaus, 4000 to 5000 feet above sea level, are not so. The rainy season extends from December to April. Large areas are covered with bush, elephant grass, and jungle, but other areas are open.

There is a railroad from Dar-es-Salaam to Lake Tanganyika, a distance of 600 miles, and another from the port of Tanga to the Kilimanjaro district, 200 miles. There are also a number of good roads. [These are described with reference to map.—Ed.]

The British troops engaged in the German East African campaign were mostly from the South African Union, Rhodesia, and Nyasaland. There was one regular British regiment, certain Indian units, the Nigerian regiment, and the King's African Rifles. The principal force of 17,000 was conveyed by sea to Mombasa, which became the base of operations.

EUROPEAN WAR—Continued

Gen. Sir Horace Smith-Dorrien was designated for command, but fell ill and the command was given to Gen. Smuts.

An attempt to land at the German port of Tanga in 1915 had ended in disaster. Mombasa, in British East Africa, was near the German frontier, and the Uganda railroad ran thence northwest near the border, and a branch ran to within 25 miles of Moshi, the termius of the Tanga railroad. Moreover, the Kilimanjaro district was fertile and hence valuable, and hence formed a good first objective, certain to be vigorously defended. Moshi and the Tanga railroad were taken only after some severe engagements, but with this railroad in his possession, Gen. Smuts' communications were made shorter and absolutely safe.

In the summer (*i. e.* June-August) of 1916, Gen. Smuts operated southward and cleared the enemy from the country between the northern frontier and the Das-es-Salaam-Lake-Tanganyika (=central) railway, the principal action being fought at Mhonda on Aug 10. He thus secured control of the railway from Kilimantindi to the coast, but the Germans had wrecked it so thoroly that it was useless for a long period. Complete control of Lakes Tanganyika and Victoria Nyanza was secured by the British and Belgian naval forces. The Belgian Field Force under Gen. Tombeur meanwhile advanced from the west on Tabora, and a column of 4000 colonial troops under Gen. Northey advanced from the southwest from German Nyasaland (occupied in June). The latter inflicted severe losses on the enemy at Malangali and Lupembe, and were approaching Neu Iringia.

The remainder of the article is concerned principally with the operations of Gen. Northey's force. The total German forces in East Africa were estimated at 4000 European and 25,000 native soldiers, with plenty of machine guns and artillery, including two naval guns from the *Königsberg*. The main body, under Gen. von Lettow-Vorbeck, was engaged with Gen. Smuts. A detachment watched the Belgians in the northwest, and a force of 200 Europeans and 1000 to 1500 native troops with guns and machine guns, opposed Gen. Northey. Gen. Northey moved forward, fighting various actions and occupied Neu Langenburg. Towards the end of June, he prepared for a further forward movement in the general direction of Neu Iringia, an important startegical point 175 miles from Neu Langenburg, and the junction point of several roads.

The general situation was promising. Gen. Smuts had defeated the enemy main force near Handeni, and had occupied the region north of the Central railway. The Belgian force was pressing the enemy in the northwest. Difficulties of supply and communication forced Gen. Smuts to halt his operations for three or four months, and the German troops retiring before the Belgians made a determined attempt against Gen. Northey's line, which partly succeeded. The force under Gen. Northey was none too large for the work assigned. Had it been larger it might have played an important part. Instead its position was at times precarious. By the end of August Gen. Northey was at Neu Iringia. His line of communications stretched back 175 miles, and was liable to attack from the east and later on from the west, requiring practically the whole force to defend it. A reinforcement of 500 men had to be used for the same purpose.

Reports came of a threat to Gen. Northey by the German force retreating before the Belgians. Gen. Smuts sent a reinforcement of 300. There was great difficulty of supply of Gen. Northey's force either from its own base or from Gen. Smuts' position. Now came the German operations against Gen. Northey's communications. Several actions were fought, and by the end of November the enemy had been cleared out of Gen. Northey's area after suffering heavy loss. But now came the rains and with them great difficulties of supply, and in late December Gen. Northey had to retire to Lupembe.

The main German force retired meanwhile to the Rufiji River. Gen. Smuts landed a force at Kilwa (135 miles south of Dar-es-Salaam) which penetrated 60 miles inward and threatened the Rufiji defenses in rear. There was considerable fighting along the Rufiji and Mgeta Rivers, resulting in the retirement of the enemy on Jan 7, 1917. On account of the climate—now midsummer only 8° from the equator, Gen. Smuts withdrew his South African white troops. The Germans continued a gradual retreat southward offering active resistance to the pursuing native battalions. Gen. Northey's operations continued and on Jan 20 he was reported as pursuing the enemy towards Mahenga, and a later telegram reported the surrender to him on Jan 24 of a column of 39 Europeans and 250 native troops 55 miles northeast of Songea.

Probably in May—after the rains cease—the final stage in the campaign against the Germans, now south of the Rufiji River, will begin. The numbers engaged have been small compared with the forces in other theaters, but the theater has been large, and the operations have called for arduous work.

Togoland

On the 3rd of August, the governor of Togoland proposed to the British in the Gold Coast on the west and to the French in the colonies on the east, that neutrality be maintained in all these colonies during the war. The English and French both refused to adopt this plan, and after a conference of the two governments, the English governor of the Gold Coast, in charge of the operations, decided upon the following plan: The main column, starting from Lome on the coast would advance on Kamina, following the railroad. A second column, organized in the north of the Gold Coast, would enter Togoland from the northwest and advance on Yende. Finally, two other columns, organized on French territory, would invade the colony, the first advancing on Lausango-Mango from the north, and the second marching directly on Kamina from Dahomey.

The German forces numbered 1000 men and they had also armed a number of the natives. They had three Maxim guns.

The French had in the main column, under Major Maroix:

One company, native Dahomey troops (three officers, 210 rifles).

The expeditionary company of the Ivory Coast (three officers, 210 rifles).

One company mobilized reservists.

One section mountain artillery (two guns with 300 rounds apiece).

One company of the Military Territory of the Niger (80 rifles).

One Mossi company.

A sanitary unit was organized in Savalou.

The English had four companies, of about 120 men each, and two guns, under Lieut.-Col. Bryant.

On the 7th of August two companies of British troops occupied Lome, which the Germans had evacuated for a concentration of their forces at Kamina. The French column entered Petit Popo from Dahomey at the same time and from there proceeded to join the British force.

Marching on Kamina, the British column encountered a small force of the enemy, whom they dislodged from their position on a crest on the 16th of August.

On the 18th, the French forces joined the English column and Lieut.-Col. Bryant, commander-in-chief, ordered the advance on Kamina.

The advance guard established contact with the enemy on the 22d, when the Germans were found strongly intrenched in the village of Chra, on the river of the same name. The English forces consisted at that time of three companies, divided in two columns. The French had three officers and 150 men. The British were to attack in front and also to envelop the right flank, while the French attacked the left flank. The attack failed on both wings, the nature of the ground having made it impossible to use the artillery. The losses of the Allies were two officers and 20 native troops killed, and two officers and 48 native troops wounded.

During the night the Germans evacuated their strong positions to retire on Kamina, which was then menaced by the French force approaching from Dahomey.

On the 26th of August, the Dahomey column, four officers, 300 rifles, two mountain guns, arrived before Kamina, and the following day entered the city from the east, at the same time that the Anglo-French force was entering from the west.

The capitulation was unconditional and included all the troops of Togoland. In this campaign of 15 days, the Allies captured 206 European prisoners, 3 Maxim guns, 940 rifles, 142 carbines, 208,800 rounds of Mauser ammunition, 90,000 rounds of various other kinds of ammunition, railroad stock, automobiles, great quantities of explosives, telegraph equipment and public funds.

The column operating in the northern part of the colony had advanced on Lausango-Mango and occupied it without resistance about the same time the Lome column occupied Kamina.

After the surrender at Kamina the territory was divided between the English and the French.

NAVAL OPERATIONS

[The Jutland Battle. Translated and Abridged from Capt. Scheibes' "Die Seeschlacht vor dem Skagerrak." *Jour. Royal United Service Institution,* Feb, '17. 5500 words. 5 sketch maps.]

(In general, the phases and their sequence in the action are as described in accounts heretofore published in the INTERNATIONAL MILITARY DIGEST. The articles emphasizes the fact that the action was fought almost as far from Heligoland as from the English coast; that it was in the nature of an encounter action, there having been no air reconnaissance; and thruout attributes the aggression in the main to the Germans. The author claims a victory for the German fleet, which he states remained in the vicinity and sought a renewal of the action on June 1.

He gives the strength of the fleets as 2 to 1 in favor of the British, and the losses in big ships as 4 to 1 and in smaller ships 2 to 1 against the British. He states that the reason the battle was not fought to a finish was because the British made no attempt to resume the action.)

[Story of the Königsberg. By Arthur Pollen. *Land and Water,* June 21, '17. 3000 words.]

The *Königsberg* was a light, unarmed cruiser of about 3400 tons displacement. She was laid down in 1905. Her armament consisted of ten 4.1-inch guns and she was protected by a 2-inch armored deck.

On the eve of the outbreak of war she was seen by three ships of the Cape Squadron off Dar-es-Salaam, the principal port of German East Africa. She was then traveling north at top speed, and was not seen or heard of again until, a week later, she sank the British steamer *City of Westminster* near the island of Socotra.

Three weeks followed in which there was no news of her whereabouts.

About the 20th of September she came upon H. M. S. *Pegasus* off Zanzibar. *Pegasus* was taken completely unawares while she was cleaning furnaces and boilers and engaged in general repairs. It was not possible then for her to make effective reply to the *Königsberg's* assault, and a few hours after the *Königsberg* left she sank. Some time during October the *Königsberg* entered one of the mouths of the Rufiji River, and was discovered near the entrance on Oct 31 by H. M. S. *Chatham.* From then onwards all the mouths of the river were blocked, and escape became impossible.

Her captain seemingly determined, in these circumstances, to make the ship absolutely safe. He therefore took advantage of the high water tides, and relying partly on his own engines, partly on being towed, and possibly on poling, forced his vessel about 12 miles up the river.

EUROPEAN WAR—Continued

She was located here by airplane at the end of November, and was destroyed by the monitors *Severn* and *Mercy* on July 11, 1915.

(There is included in this article a very interesting account of the destruction of the *Königsberg* by an officer who was a participant in the engagement.)

—Chronological History of, by Theaters

See also

Kut-el-Amara, Battle of

[Chronicle of the War Situation, Dec 5, 1916. *Memorial de Caballería,* Dec, '16. 2500 words. 2 maps.]

(An account of the European war by theaters under the headings: Rumania, Macedonia, France, Russia and the Submarine War.)

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[Chronicle of the War Situation on Jan 5, 1917. *Memorial de Caballería,* Jan, '17. 2200 words.]

(A continuation of the chronological account of the European war published in this journal.)

GENERAL

It was a dramatic scene in the Reichstag on Dec 12, when Bethmann-Hollweg announced to the world that Germany was ready for peace. Coming tho it did at the climax of a brilliant campaign, this proposal was nevertheless hailed as a proof that Germany was suffering grave distress. The very campaign being waged so successfully had been launched and prosecuted, it was reasoned, in the hope of winning a victorious peace. The first impulsive answer of Allied public opinion was an indignant *No.* But it was soon seen that an unqualified refusal on their part to discuss terms would shift the burden of responsibility for the continuance of the war on their shoulders, and give Germany a diplomatic advantage,—whatever the real meaning of the latter's proposal. The answer of Lloyd George, given in the British Parliament the following week, demanded that the Germans should state their terms, but did not close the door to further negotiations. President Wilson's note, framed before the declaration of the Central Powers, together with the attitude of other neutral countries, has made the situation further complicated.

In other ways as well, political developments have been prominent this month. Important changes have occurred in the political heads of at least five of the warring powers—England, France, Russia, Austria, Rumania. The fall of the Asquith ministry, after its long tenure of office, is attributed to dissatisfaction with the conservative, bungling management of the war that has made splendid British efforts count for so comparatively little. Lloyd George, the new prime minister, is generally regarded as the strongest statesman in the Empire, and his new war council of five should be much more efficient than the former large and unwieldy cabinet. A similar centralization of authority has taken place in France, altho the premier remains unchanged. One of the members of the council, Gen. Lyautey, the new Minister of War, is a soldier and administrator of demonstrated capacity. Here, too, there has been a shifting in the military command. Joffre, whose work has been done, and well done, in the earlier part of the war, gives way to younger and more aggressive men, and retires to an advisory position, with the title of Field-Marshal. Generals Nivelle and Pétain, both heroes of the fighting about Verdun, assume the leadership of the field armies. The Russian reactionary premier, Stürmar, who was suspected of being friendly to the Germans, is replaced by Trepoff; one of the latter's first official acts is to state that England has promised Constantinople to Russia. The death of Emperor Francis Joseph of Austria terminated a remarkably long and stormy career; in addition to having a new king, Charles Francis Joseph, Austria has acquired a new premier, Alexander Spitzmüller. The former premier of Rumania, Bratiano, under whose leadership Rumania made her unfortunate decision to take up arms, has resigned, together with all his cabinet. The political situation in Greece will be touched upon later.

Turning to the campaigns in progress, the Rumanian theater is easily first in interest. Thruout the earlier stages of the Germans' attack, the optimistic tone of the Allied press had concealed the true condition of affairs. The news of the capture of Craiova on Nov 21, came as a surprise to many who had been led to believe shortly before that the Rumanians were making headway at the Vulcan Pass. This success sealed the fate of the Rumanian Orsova army, and thereafter the march of events followed rapidly—the brief stand of the Rumanians on the Alt River, Mackensen's crossing of the Danube to join with Falkenhayn in crushing both flanks of the Rumanian defensive line, the disorganized retreat of the latter all along the line, the abandonment of the capital without a fight, and the rapid and still unchecked pursuit by the invaders, with enormous captures of prisoners, munitions, and food supplies. Confronted four months ago by a threatening problem of unprecedented difficulties, the Central Powers have conducted a campaign which, for skillful planning, well-timed coordination, and adequate execution, finds few equals in the history of warfare.

The prize that the Germans have won in this conquest has been described as follows in the ***Independent:***

"Rumania will supply just what Germany needs, Rumania is a little country, smaller than Illinois, yet it has stood next to the United States and Russia in its output of petroleum and—until Canada and Argentina developed—in its exportation of wheat. It produces enough surplus grain to give every man, woman and child in Germany a loaf of bread every day. Rumania could remount the German cavalry and provide wool enough to clothe a German army. Besides this, a conquered Rumania could be drawn upon for half a million men, some of whom could be induced—by the use of sufficient force—to join the Rumanians in the Austro-Hungarian armies, and those who would not fight could be used, like the Belgians, French and Poles, to replace fighting men in factory and field."

In view of the magnitude and far-reaching consequences of such a triumph, it is hard to understand

why the Allies, particularly Russia, have not rendered more assistance to their latest ally. The Russians, it is true, early sent a force into the Dobrudja, but one entirely inadequate in size to cope with the situation. Their counter-stroke delivered later in the Carpathians was intended to relieve the pressure of the German invasion, but came too late and too far away from the main theater to accomplish much. As early as Oct 1, German foresight had provided for a civil government for the country-about-to-be-conquered, with a corps of experts in agriculture and petroleum; but the leaders of the Allies, judging from their actions, seem to have been blind to such possibilities.

Another lunge by the French at Verdun found the German line thinly held, and extended the boundaries of the strip of land regained a month ago from the Germans. For the most part, however, a lull has succeeded on this front which seems likely to continue for the winter.

In Macedonia, the capture of Monastir a month ago has yielded little fruit to the Allies in the way of further advance. The military situation still hangs on the political, which is more than ever involved. The new English prime-minister has intimated that a still more uncompromising attitude will be adopted by the Allies toward Greece.

Two more Zeppelins have fallen victims to English anti-aircraft guns and defending planes. They were engaged in two raids against England on Nov 27-28, one of these raids being made over London in the afternoon.

The activity of German U-boats is increasing and extending. The new submarines have a larger cruising radius, and can stay out for weeks without a tender. They range the shores of Norway, France and Spain; the Mediterranean is dangerous water for vessels of all classes; and a repetition of their raid on this side the Atlantic is feared. Insurance rates have gone up, and Great Britain, as well as Germany, now has a serious problem in her food supply.

January

No new campaign nor fresh political upheaval signalized the advent of the New Year; rather the last month has been characterized by the aftermath of the remarkable developments of the preceding weeks. The Entente Allies have replied in no uncertain tones to their opponents' peace proposals; neutral nations have registered their reactions as well; and altho peace may be no nearer for these overtures, rumors of peace and peace talk have persisted, and will probably continue to persist. The Rumanian campaign continues to occupy the center of the military stage; and the Rumanian collapse is seen to be more than ever complete. Just how significant this failure appears can be judged from such opinions as that of Mr. Frank Simonds, who has up to this time believed that the Allies would ultimately be able to gain a military decision, based upon superior number and resources. Writing in the January *Review of Reviews,* he now says: "It seems to me that with the collapse of Rumania this chance has disappeared. . . . I can no longer see any warrant for belief that the Allies will go to Berlin or even to Vienna; and my judgment is that economic rather than military elements will settle the war, that the military battle is tending toward a draw, a real draw, a failure of both sides to get a decision."

A month ago, while the Rumanians were fleeing from their capital, and the unchecked Teutonic forces were completing the conquest of Wallachia, the Russians were taking up a strong position in front of the Sereth, stretching for seventy-five miles from the Danube to the Carpathians, and containing the fortified cities of Focsani and Braila. These fortifications, originally built as a protection against the Russians, were now occupied by the latter, with their front reversed to face the south. Here, if anywhere, the Russians might hope to check the German advance. For a while the offensive in the center paused, as if to give the German-Bulgar army in the Dobrudja a chance to draw up even. This it did, Sakharoff being obliged to fall back, despite persistent resistance, until he was forced to retreat across the Danube, under cover of the fortified bridge-head of Macin; and this invading column was fairly abreast of its neighbors across the Danube. Then followed fresh advances, on both banks of the Danube, in the center toward the Rimnicu line, and—new menace to the defenders—down thru the narrow and difficult passes of the Carpathians that flanked the Russians' right. By the second week in January, Macin with its bridge-head, Braila, important river city, and Focsani had all fallen, and the Russians—with ever stiffening resistance, it is true—had been driven back to, and in some places across, the Sereth. Here they are strongly posted, and have been able to make offensive returns. Galatz, the key position which commands the lower Danube, remains untaken; and it is not yet evident whether the Germans have—either voluntarily or of necessity—stopped at this line, or whether they will drive thru into Besserabia, toward the tempting seaport of Odessa, 125 miles away.

Despite some occasional activity on the Somme battlefield, German newspaper criticism regards this campaign as a closed book, an opinion which is shared by many neutral observers. To quote Mr. Simonds:

"The Allies have failed to break thru at the Somme, and the Somme is a defeat for them, as Verdun was a defeat for the Germans. Not even the local success that would have been proven by their occupation of Bapaume and Péronne, as I pointed out months ago has been achieved, but it is true, on the other hand, that they were at one time near to a considerable victory and the Germans very seriously considered a shortening of their western front."

It is significant of Britain's increasing responsibilities as to man-power that the English have taken over from the French an additional ten miles of front in this sector.

When Alexander Trepov succeeded Stürmer as Premier of Russia, it was hoped that his accession promised the beginning of a constitutional régime, as well as a more efficient management of the war. The new premier created a sensation by announcing in his first speech to the Duma that at the time when

EUROPEAN WAR—Continued

Turkey entered the war: "We concluded an agreement with our allies which establishes in the most definite manner the right of Russia to the Straits and Constantinople. Russians should know for what they are shedding blood and, *in accord with our allies*, announcement of this agreement is made today from this tribune."

But the Trepov régime lasted less than two months. The assassination of the mysterious monk, Rasputin, the Czar's favorite adviser, is said to have so angered the latter that he determined to put an end to parliamentary government. In any event, Protopopov was appointed Minister of the Interior, Premier Trepov was dismissed, and for his successor a pronounced reactionary was selected in Prince Galitzin. The latter's watchword, he has announced, will be: "Everything for the war—everything for victory."

The admission of Turkey to equal alliance with Germany and Austria-Hungary has emboldened her to repudiate the suzerainty which the European powers have exercised for the last sixty years.

In a note addressed to Germany and Austria-Hungary (Jan 1), and communicated to the neutral nations, the Ottoman government (which had previously renounced the privileges granted to foreign residents) now declares its independence and announces that it no longer regards the conventions of Paris and Berlin as binding upon Turkey.

A conference between Mr. Lloyd George, the British Premier, and the French and British military leaders, Generals Nivelle and Haig, took place Jan 15 and 16.

A report has gained considerable credence that the Germans plan to invade French soil from a new direction, by crossing a corner of Switzerland. The report was originated on account of the supposed mobilizing of certain German units near the Swiss frontier, and was answered by the mobilization of fresh Swiss troops, in addition to those hitherto with the colors.

A new German commerce destroyer has made her appearance in the South Atlantic, and is credited with having disposed of about 20 ships, 2 French, 1 Norwegian, and the rest British. Most, if not all, the ships sunk were carrying munitions or other contraband. It is a similar story to that of the *Moewe*—indeed it may be a reappearance of the *Moewe* herself. Particularly daring was the exploit of the *Yarrowdale*, which, with a prize crew of sixteen Germans, ran the blockade and carried into Germany 469 prisoners (three of them Americans) from the destroyed vessels.

Such losses, together with those from the energetic German submarine campaign, have proved alarming to British ship-owners. Prominent Englishmen have said that the loss of shipping was so great that unless checked England would be blockaded as well as Germany. Measures of relief are promised, in government supervision of food supplies and in the more rapid construction of new vessels; and the keenest efforts will be made to negative the activity of the submarines.

February

Truly the Great War is approaching a crisis. The greatest experiement of the age is being tried, at a daily cost of thousands of tons of shipping, while the world looks on aghast, hardly conceiving what the import of it all may be.

"On the last day of January the German Ambassador, Count Bernstorff, delivered to our State Department an announcement that since Germany's proffer of peace negotiations had been rejected by the Allies the German Government is now compelled to continue the fight for existence, again forced upon it, with the full employment of all the weapons which are at its disposal.

Accompanying this note was a statement of the contemplated military measures at sea. This declares that

From Feb 1, 1917, sea traffic will be stopped with every available weapon and without further notice in the following blockaded zones around Great Britain, France, Italy and in the eastern Mediterranean.

The "barred zone" extends completely around the British Isles and along the western coast of France and Belgium, but leaves a free strip twenty miles wide bordering Spain and Holland. Provision is allowed for one passenger ship to and from America every week, under certain conditions.

On Saturday, Feb 3, President Wilson gave Ambassador Count Johann von Bernstorff passports for himself and his official staff. At the same hour, two o'clock in the afternoon, when the German Ambassador received his passports President Wilson addressed a joint session of the two Houses of Congress.

The break with Germany had been generally expected, but the promptness of the President's reply surprised many. The members of Congress and the crowded galleries greeted Mr. Wilson's speech with applause and enthusiasm. Indeed, almost the entire country seemed united in endorsing the stand thus taken. The break extended to all consuls and consular agents as well as to the ambassadors; the interests of the United States in Germany were assumed by the Spanish legation, while the Swiss embassy took over Germany's interests here.

Other neutral nations. altho encouraged by the President to follow our example, have as yet not done so. Most of them, however, have protested more or less strongly against this action on Germany's part; more than this cannot be expected from the smaller states near enough Germany to fear her displeasure.

While the United States wishes to avoid war, any "overt act" on the part of German submarines in sinking American vessels may at any time precipitate hostilities. In the meantime, the daily record of the U-boats is being scrutinized anxiously. From Feb 1 to Feb 23, the Germans had sunk, according to British figures, 158 vessels (97 British) with a total tonnage of 293,000 tons, an average of about 13,000 tons a day. German figures make considerably larger claims. The total tonnage of English shipping is estimated at from twelve to fifteen million tons. The Germans calculated that they could win by sinking 33,000 tons a day. They have fallen far short of this. On the

other hand, they can achieve their purpose equally well by keeping shipping off the seas; and we know that in this country the blockade has had the effect of suspending the operations of the principal American lines. How many submarines the Germans have, and how many they have lost, these vital facts are not disclosed. Certainly England regards the food situation as serious, and does not attempt to conceal this fact.

As regards news from the various battle fronts, it has been a comparatively uneventful month. In the Rumanian theater, there has been an almost complete cessation of hostilities. As seen last month, Russian resistance had gradually stiffened as the Germans approached the Sereth, and this increasingly successful opposition, added to the prevailing extreme cold, evidently discouraged the invaders from pushing the attack further in this direction. Allied figures place the total invading force at about 575,000, of whom Austro-German troops were supposed to number 300,000, the Bulgars 200,000, and the Turks to make up the rest. There are evidences that a large part of this force, which undoubtedly included some of the flower of the German army—has been withdrawn for service elsewhere.

With the approach of Feb 21, the anniversary of the beginning of the Verdun campaign, the Western front has waked to renewed activity. While the raids continue as before, more extensive operations have also been initiated, by the Germans in Champagne, and by the British on the Somme. Indeed, the Somme offensive is described as having recommenced, and the British claim to have made considerable progress toward Bapaume. General Haig, as is evident from his reports, regards this sector not merely as a battlefield, but as an arena in which he has defeated one German army after another in turn. The English evidently feel that the war may as well be fought out right here as elsewhere. Apparently they have taken over about 12 miles of front previously held by the French. Weather conditions are becoming more favorable for fighting, and a marked increase is evident in aerial activity. The British losses for January are published as 32,000 men.

At the northern end of the Russian front, where the frozen marshes make this in some ways the most favorable season of the year for military operations, the Battle of the Aa has continued, with some interruptions, into the middle of February. For the most part, the Germans were the aggressors, their object being to win back the territory taken by the Russians last month. General Dmitrieff, the Russian commander (known four years ago as the Bulgar Napoleon because of his success against the Turks, but now fighting against Bulgaria) in a congratulatory order to his troops, claimed the capture of 30 cannon, 15,000 rifles, and much gold and other booty. The German counter-offensive, which commenced on Jan 23, succeeded in regaining most of the lost territory.

Another theater that has figured prominently in the recent despatches is the far east, where the British force below Kut-el-Amara is striving to retake this city, and wipe out the sting of its loss. During the month, they have made considerable headway in the attempt to surround and cut off the Turkish garrison.

"Two sharp engagements between British and German light craft were fought in darkness off the Dutch coast on Jan 23 at close range. The German boats, it would seem, started from their base near Zeebrugge to make a raid in the North Sea under cover of night and fog, but were intercepted by British boats and forced to turn back. The accounts of the fights are somewhat conflicting. The British official report states that one of the German craft was sunk and the rest scattered, having suffered considerable damage. A second sharp engagement between torpedoboat destroyers took place after midnight of Jan 23, in the vicinity of Schouwen Bank, during which one British destroyer was torpedoed and three of her officers and forty-four of her crew were lost. The fog was too thick to permit exact observations of the damage inflicted on German craft." (*Army and Navy Journal.*)

According to the estimate of the *New York Times*, on Dec 31, '16, the total cost of the war to date had reached the stupendous sum of $61,800,000,000; while the daily cost to the belligerents was now $105,000,000, divided in the ratio of two-thirds to the Allies and one-third to the Central Powers.

"The aggregate direct cost of the twenty greatest wars in the century and a quarter preceding the outbreak of the present struggle was not in excess of $22,000,000,000."

March

"History marches with seven-league boots!" So it appears when a revolution can be consummated in Russia in a week. After a four-days' period of silence, the dramatic announcement of the Czar's abdication on Mar 15 came as a startling surprise to most of the world. It is the purpose of this review to touch upon political developments only as they influence the military situation, and it is much too soon to determine what the effect will be in the present case. Certainly the new régime should combat the old inefficiency, corruption, and treachery, under which handicaps the army labored. the graft that permeated Russian officialdom, the munition scandals, the treachery that betrayed campaign plans, the pro-German influence that extended to high places—these Russia is striving to put behind her. On the other hand, a government cannot be made over in a day or a month; the country is generally unsettled and disorganized, and faces serious problems—altogether, effective military efforts are not to be expected from Russia for many months to come. An immediate effect of the revolution is to relieve from his command the Grand Duke Nicholas, the able general who defeated the Turks in Armenia.

The unrestricted submarine campaign is now two months old. Its success or failure is still problematical. During this period, about a million tons of Allied shipping has been destroyed, or half the amount Germany announced as her estimated expectation. Visitors in England have found no shortage of food, except, perhaps, of sugar, but the government recognizes the existence of a grave situation, and is taking every precaution to conserve the available supplies. One au-

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thoritative report comes that 25 German submarines were accounted for in the first fifteen days of the blockade thru the increased watchfulness of the British defense system. In any event, this campaign is generally recognized as the one remaining hope of the Central Powers of bringing England to her knees and winning a decisive victory. They will continue to work it for all it is worth.

However effective or not in its main purpose, the submarine warfare has had a very important effect overseas. The United States now stands on the verge of war with Germany. After the diplomatic break precipitated by the German chancellor's announcement of Jan 31, the estrangement between the two governments developed rapidly. When it became evident, by the sinking of the *Laconia* (Feb 25), the *Healdton* and other American vessels, that Germany had no intention of sparing our merchantment, President Wilson, with the virtual approval of Congress, gave our vessels the right to arm. The disclosure of Germany's attempt to negotiate treaties with Mexico and Japan further antagonized America, and at the end of March the nation awaited the action of the new Congress that had been called in special session by the President.

The characteristic tenacity of the British has again been demonstrated. Gen. Maude, not content with the recapture of Kut-el-Amara, followed up this victory so energetically that the retreating Turks were kept on the run, and two weeks later the English entered Bagdad. This ancient Oriental city and its influence upon the rival ambitions of the great European powers makes an appeal to the imagination that is perhaps hardly warranted by military considerations. Nevertheless, this reversal of their previous defeat is welcome news to the British, and, taken in conjunction with the fresh Russian advances in Persia, and the English expedition into Palestine, it presages the downfall of the Turk in the Far East, as well as the frustration of Germany's hope for an eastern empire.

However far afield the observer's eye may wander in following this world war, it returns inevitably to the western battle front, where have been and are being fought the greatest conflicts of history. During the past forty days, the French and English have taken over from the Germans an area ten times as extensive as that won by them in all the months of the furious fighting on the Somme. The first considerable retirement occurred late in February, when the Germans deserted the threatened salient just west of Bapaume. This had a merely local effect, however, leaving the Germans in a stronger position, and still holding Bapaume. But March saw the Germans withdrawing all along the hundred-mile line from Arras to Soissons, skillfully retreating over an area laid waste behind them, to a new line from ten to twenty-five miles to the rear. Whether they were to stand on this "Hindenburg line," as it was called, or whether the retreat was shortly to continue to a line nearer the frontier, was not evident at the end of March. Certain conclusions, however, could be clearly drawn.

The withdrawal was a sign of German weakness. Some of the old positions had become so swept by shell-fire, the fortifications so battered, that they could scarcely be considered tenable any longer. The retreat renders the Battle of the Somme a virtual victory for the Allies, and confirms Gen. Haig's statement that the British were near to a substantial victory last fall. Moreover, the shortening of the line effected by vacating the Noyon elbow releases perhaps some hundred thousand men, and thus points to a weakness in man-power on the part of the Central Powers.

On the other hand, it must be recognized that this move gives the Germans some very real advantages. In addition to the saving of men effected in holding the shorter line, it temporarily paralyzes any Allied offensive in this region. To organize their new positions, to build communication lines across this desolated area and prepare anew for an advance, must take the Allies weeks or months. Meanwhile, the Germans are free to start their own offensive elsewhere; moreover, they gain time while waiting for their submarine campaign to achieve the results they hope for. Therefore, by *giving* the enemy the territory the latter would otherwise would have to take (territory which has little military value intrinsically), the Germans practically resort to the gambit strategy of chess, making a sacrifice to win the initiative and the hope of ultimate advantage.

The destruction of the French battleship *Danton* by a German submarine in the Mediterranean Sea, Mar 19, 1917, was one of the most important naval losses of the war to the credit of the submarine. The *Danton*, laid down in 1908, was a vessel of 18,400 tons. Another noteworthy submarine achievement was the sinking of an armed transport steamship of 34,500 tons in the Mediterranean on Feb 24. Some of the Colonial troops on board were reported lost.

"The German Admiralty on Mar 22, 1917, announced that the slippery German auxiliary cruiser *Moewe* has safely returned to her home port in Germany, after her second cruise in the Atlantic Ocean, where she stayed several months and captured twenty-two steamers and five sailing ships of a total of 123,100 gross tons."

A Dutch report of a "baby submarine" operating on the high seas from a mother ship gives some support to the recently projected American "pill-on-a-pole." According to the officers of the steamer, their vessel was stopped by a German submarine hardly larger than a decked-over canoe.

Mr. Frank Simonds, returning from a two-months' visit to France and England, revises his previously quoted statement concerning the improbability of a definite military decision. Writing in the *Reviews of Reviews* for April, he states that there is in those countries no thought of a peace by negotiation in advance of a victory on the battlefield that shall shatter Prussian military prestige; and that the Allied soldier, satisfied that the German military machine is breaking down, is supremely confident of ultimate complete triumph. Mr. Simonds also describes the British army as he found it, equipped, munitioned, and cared for

"as are no other troops about whom I know anything." He compares the army in France to-day to the Army of the Potomac in 1864, an immense sledge-hammer, a volunteer army made up from the best manhood of the nation, with its high commanders the best of the old regular army. "The British," he says, are now firing four shells to the German's one, ... but the spirit remains that of the men who died at Ypres when the odds were five to one and the losses approached actual annihilation."

The same writer also gives (New York *Tribune*, Mar 28) the present disposition of the five British armies in France and their commanders: General Plummer, with the First Army, occupies the Ypres sector; the Second Army, under General Horne, faces La Bassée; General Allenby commands the Third Army opposite Arras; Generals Gough and Rawlinson, whose armies are making the present advance, were General Haig's chief assistants in his campaign on the Somme last year, and received high praise in the latter's report.

April

The term "European War" has been fairly outgrown. We have seen British and Russian troops joining hands near Bagdad, Canadian and East Indian forces fighting in France, Australians invading the Holy Land, Japan has carried the war to the isles of the Pacific, and the shock of combat has been felt in the deepest jungles of Africa. Now we find being staged in the United States an important council on the conduct of the war, and this great nation, wonderfully transformed overnight, is fairly committed to a policy of conscription, recently so foreign to its thought. Nothing less than "World War" can adequately describe the mighty conflict.

The United States became the thirteenth belligerent on Apr 6. The action that this government would take was never in doubt after President Wilson's masterly address to Congress on Apr 2, in which he advised that a state of war be recognized as existing. This speech was received by the country with universal approbation; after a long-restrained forbearance, the American people entered the war with remarkable unanimity, convinced that the safety of democracy demanded the overthrow of "Prussianism."

This alignment of the United States on their side tremendously heartened the Entente Allies. The new enlistment was first of all a moral endorsement of the issues for which they were fighting. But the entrance of this wealthy new belligerent promised, in addition, very real material advantages. The first token of these was manifested on Apr 14, when the House of Representatives passed without a dissenting vote the largest single loan on record—$7,000,000,000—nearly half of which it was planned to place at the disposal of the Allies. Another problem of growing concern, in which the aid of the United States was involved, was the question of food supply, both of the food itself and the necessary vessels for its transportation, the numbers of which were being seriously impaired by the U-boat campaign. Munitions, of course, the Allies would expect to continue to receive from our factories, perhaps to an increasing degree. Finally, there was the question of man-power. Altho the United States was not prepared to send troops to Europe at present, her allies could look to her as an eventual source of supply of great capacity.

In order to present the Entente point of view, and to secure co-operation with the new ally, England and France sent to America some of their foremost statesmen and soldiers. These commissioners, among whom were Mr. Balfour, Marshal Joffre, and M. Viviani, were enthusiastically welcomed in this country. Their presence, and their representations of conditions in Europe, had no little effect in intensifying the work of preparation that was going on in Washington. On Apr 28, a test vote taken in the House showed that body to be overwhelmingly in favor of conscription as the only adequate method of raising an army; and the administration's program, as embodied in the army bill, was finally authorized.

The British army has furnished fresh proof of its new-found strength. The Battle of Arras was a British victory which, Mr. Frank Simons thinks, "may rank with one of the greatest triumphs in history, as it must now stand as the greatest military triumph in British history, one of the very few won by British arms unaided by allied forces." Certainly the results of the week's fighting were impressive—a gain of from two to six miles over an eleven-mile front (six miles in six days as against six miles in six months on the Somme); the capture of 15,000 prisoners and 200 guns, besides 250 machine guns. The capture of Vimy Ridge alone was no mean achievement, as the heavy losses in previous unsuccessful attempts testified. Finally, there were not lacking evidences that the Germans, outgunned and outmatched, became badly demoralized. It is hard to account otherwise for the unusual losses in heavy guns, to say nothing of the numerous prisoners; nor did the desperate and costly German counterattacks indicate that it had been any part of the German plan to abandon this part of the line. Here was the northern pivot on which her retreating Somme army had swung back; a break here would threaten the security of the whole line.

Just as the English thrust was delivered at one pivot of the newly established German line, so the French struck, a week later, at the southern end. The results were comparable with those of the British effort. The French were able to gain less distance toward their objective—Laon—and took only half as many guns; on the other hand, they counted more prisoners, no less than 20,000. They had won, moreover, positions on the heights north of the Aisne which promised a more effective advance against Laon; the battle may perhaps be regarded as a good beginning to a more extensive campaign.

The French and British attacks, which may be regarded as parts of a single co-ordinated plan, were directed at the best possible objectives. They could not have been delivered anywhere between, for we have seen how the Germans, by retreating behind a desolated zone, purchased immunity from any such organized attacks for some weeks. It was sound strategy, then, to bring fresh pressure upon the withdrawn line

by gnawing at both its supports, just as a wave undermines the foundations of the building it would destroy. The remarkable thing was that the Allies were ready to attack so soon, either because they had foreseen and provided for such a contingency as the German retreat, or because they were able to adapt themselves very quickly to the changed conditions. If the Germans, as indeed seemed reasonable, had thought to gain the initiative by their retreat (in fact, an offensive on their part was generally expected), they did not act quickly enough to take advantage of their opportunity. Their subsequent moves have seemed to be more or less forced. There is every reason to expect a change in their defensive status, however. Germany, while her losses have been enormous (her own figures state over 4,000,000, of whom perhaps half are permanent), has apparently been able to recruit her armies in undiminished numbers. With the older and less fit men now in her ranks, and other released by the Belgian deported laborers, her field armies are now estimated at about 2,600,000 men, two-thirds of whom are believed to be on the western front. Fresh development in the direction of more open fighting are not improbable, and the great battles of the past month may but mark the beginning of a mammoth conflict, surpassing anything the war has seen.

However gratifying the Russian revolution may be to the friends of democracy, the military situation in Russia is not a cheerful one for the Allies to contemplate. While much remains of mystery and conjecture, it is clear that the strength of the Russian forces has been at least temporarily weakened by the overthrow of the old régime. An offensive against Russia of the thorogoing German kind would probably have disastrous consequences for the Russians. The best reason why no such campaign has been initiated appears to lie in Germany's hope of a separate peace with Russia—a development which would open up extensive food markets for the Central Powers, release over a million of their troops from the eastern frontier, and in general play havoc with the Allies' plans.

The further progress of General Maude's campaign in Mesopotamia has been watched with much interest. The gains that his forces have made since taking Bagdad have not been impressive, and would be necessitated in any event in order to fairly secure their hold upon that city. Russian co-operation, which promised so hopefully when the Russians linked up with the British near Khanikin, has been of little real value. However, the situation is generally favorable to the English, who have suffered no real reverses, and have pushed the Turks some 75 miles back from Bagdad.

May

For most Americans, the month has been one of disillusionment. Few foresaw, when we entered the war, what demands would soon be made on the United States. But a few weeks ago, when the British and French offensives were meeting with their initial successes, the Allies seemed to be at the crest of their power. England was not suffering from any shortage of food, nor, apparently, did she fear the success of the U-boat campaign. With the assistance of American money and supplies, many thought the Allies could be depended upon to finish Germany within the year—our *men* would scarcely be needed, altho, of course, we should get ready a real army for emergencies.

This fatuous viewpoint has been pretty thoroly demolished. It has been demonstrated, as the Allied offensives slackened and then halted before the counterattacks of the German reserves, that Germany's military strength is unbroken. On the contrary, it is clear that France, if not England, is feeling the shortage in man-power keenly, and that the division of United States troops already ordered to France is but the advance guard of the sorely needed armies that will go over in increasing numbers as the war continues. A marked increase in shipping losses has brought home to England her danger; nor has progress in new construction—either of wooden or of steel ships—been such as to offer much encouragement in this respect. Finally, Russia has continued to present a dubious riddle. Whatever the final outcome may be, it is evident that the cohesion and discipline of the Russian armies has been at least temporarily destroyed. Many German units, in consequence, have been transferred from the eastern to the western front where they have helped to check Allied progress. The Germans have gained fresh heart in the hope of negotiating a separate peace with their enemies on the east, a contingency the disastrous and far-reaching consequences of which have been discussed before.

Despite these somewhat gloomy forebodings, there has been no little encouragement to the Allies in the happenings of the month. As a result of the fighting in France, they hold captive some 50,000 Germans, and have inflicted, as well as incurred, tremendous losses in this fearful warfare of attrition. Italy's armies have demonstrated an extraordinary striking power, in their well sustained offensive. Finally, the new Ally has been prompt with financial assistance; and, not unmindful of the experience of other nations, is striving with earnest spirit to make over her tiny military establishment into an adequate fighting force.

From the military standpoint, it has been one of the bloodiest and most hard-fought months of the war. This is hardly evident from the gains that either side can point to. But the halt in their advance did not indicate any let up in the Allied efforts; rather it meant that the Germans, having thrown in all available reserves, were pressing to neutralize the successes won by the Allies. The cost to both sides is read in the enormous casualty lists. "Never in human history," comments Mr. Simonds, "has there been anything comparable in magnitude or in intensity with the fighting which is now going on. A greater army than that which Napoleon took to Moscow, measured numerically, has been put out of the conflict in the first month of the Western offensive. Not less than 600,000 casualties measure the cost of a month of the battles of Arras and the Aisne. Compare with this 160,000 men who fought for three days on the battlefield of Gettysburg, with a casualty cost of 45,000. A casualty list such as the British are now bearing would mean a total loss for the present campaign—killed, wounded and cap-

tured included—of almost a million men, and it would mean not less than a million and a half for the Germans."

An echo of these losses is also heard in the relief of General Nivelle from the supreme French command; the heavy cost his offensive involved, it appears, was not deemed to have been justified by the measure of success attained. In spite of their considerable gains in territory and prisoners (their 30,000 of the latter exceded the British toll by 50 per cent), the French were dissatisfied with the results achieved by Nivelle's policy of hard hitting. The hopes raised by his success at Verdun were disappointed, and the nation turned with acclaim to the tested Pétain, in whose more conservative policy much confidence was felt. General Pétain was given the supreme command of the French armies on May 15.

A somewhat greater measure of success has been achieved by the British. Their initial stroke not only won the very formidable Vimy ridge, but broke fairly thru the main German lines (more thinly manned, it is true, than in the Soissons sector). In capturing Monchy, the point of the wedge had penetrated deeply. No trenches faced the British here short of the Wotan line some miles beyond. But during the time necessary to broaden the sides of this wedge, the Germans were enabled to throw in their strategic reserves, which had been assembled, it is supposed, for an offensive of their own. These fresh forces, with other troops drawn from the eastern front, checked the British advance, just as the German advance on Verdun had been halted the year before. There have been no important changes on their part for the last ten days. The first chapter, at least, of the British and French offensives has been written; the Germans affirm that the whole affair is a closed book.

In the two years since Italy entered the conflict, her efforts have for the most part been concentrated upon her announced goals across the Isonzo and in the Trentino. Her attainments have not been impressive; altho in reckoning them, the difficult character of this rugged country must be considered. At any rate, the Italians have at no point penetrated 10 miles into enemy country; Gorizia has been the sole city of considerable size that they have taken, while their western frontier was found to be so inadequately secured that the Austrians in their 1916 drive on Vicenza almost won a crushing victory.

Now in the present Russian crisis, the threat to Italy of a separate peace with Russia is strikingly apparent. Already the Austrians, like the Germans, have been able to detach units from the quiescent eastern front for this greater need. Much depends, then, on the outcome of this present campaign which Cadorna has initiated with such energy. The Italian strategy must be simple; their generals cannot choose except to blast away at the difficult positions which lie between them and the chief objective, Trieste. Only a narrow shelf of land lies along the coast, commanded by the port of Duino. Behind this city rise abruptly the precipitous heights of the Carso Plateau, stretching north toward Gorizia, and constituting a barrier the Italians can hardly go around. Beyond Gorizia, in the Plava sector, are other heights, not important in themselves, perhaps, but which extend and secure the flank of the Italian lines on the Carso.

The initial effectiveness of the Italian offensive has been attributed in no small degree to the heavy artillery which has been supplied by Britain. Indeed, English troops are reported to be present on the Italian front in considerable numbers, and have had a stiffening effect. The main Italian attack opened in the Plava district, then swung southward, adjacent to the Mediterranean, and has since alternated between these two sectors, having been sustained for 18 days with extraordinary tenacity. The gains have been considerable in both northern and southern sectors, and the Austrian prisoners reported number about 25,000. On the other hand, Vienna claims the capture of half as many Italian prisoners, and does not admit having sustained any serious setback.

Besides the prompt financial support that the United States has contributed, other definite methods of assistance have already materialized. The sending of a mission to Russia, headed by prominent statesmen and officers, is a significant event in the diplomatic history of the two nations. The first troops to be promised for service in Europe comprised eight engineer regiments of railroad troops, which were authorized to be immediately organized and sent to the front. Late in May it became known that U. S. destroyers had arrived in British ports on May 4, and had since been actively engaged in the defensive campaign against the U-boats. Meanwhile, at home, American inventive genius has made hopeful progress in the direction of solving this vexing submarine problem. Since May 15, 40,000 picked men have been receiving an intensive course in officer-training at a score of points thruout the United States. Finally, upon the passing of the Army bill, on May 17, a day was appointed for the registration of male citizens between 21 and 30 years, a day which should mark the initial step in the creation of a truly national army.

"A squadron of sixteen German aircraft made an attack on England, on the evening of May 25. Bombs were dropped at a number of places, but nearly all the damage occurred in Folkstone, where some bombs fell into the streets. The total casualties were: Killed, seventy-six; injured, 174. Airplanes of the Royal Flying Corps went in pursuit, and the raiding aircraft were engaged by fighting squadrons of the Royal Naval Air Service from Dunkirk on their return journey. The Admiralty reported that three enemy airplanes were shot down by the latter."

June

As the days go by, the people of the United States are awakening to a clearer realization of the magnitude of the task they have undertaken in entering the war. The complacent feeling that financial and material aid to the Allied powers would suffice for America's contribution to the cause she had espoused was apparently widespread among the mass of our population in the first days after our entry into the war. This belief had been pretty thoroly dissipated

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prior to the period now under consideration, but the events of the month of June have brought about a fuller awakening to the fact that the nation has embarked upon an enterprise which bids fair to tax its resources to the utmost. The manner in which our people are reacting to this knowledge has been a source of evident gratification to the Allied Chancelleries, who were apparently in some secret trepidation as to whether or not the United States could be counted upon to bring to their aid the full measure of assistance which our population and resources seemed to promise.

The first real indication of a general spiritual realization of the fact of war came on June 5 with the registration of all men between the ages of 21 and 31 years. The number registering fell just short of the Census Bureau's estimate of 10,000,000, while the number of men already in service brings the total well above that figure. The registration was accomplished without disorder and virtually without evasion. The result is a conclusive answer to the efforts to make it appear that this is a war forced on the people without popular approval or support. It indicates that the absence of warlike enthusiasm which some observers mistook for apathy or disapproval was due rather to a growing feeling of gravity.

Closely following the draft registration came the closing of subscriptions for the $2,000,000,000 "Liberty Loan" which was oversubscribed by more than 50 per cent., four million Americans having offered $3,035,000,000. Such a general, as well as generous, response is an excellent criterion as to the true sentiments of the people. The amount asked for is not great compared to the wealth of the nation, but there are considerations which make the result significant. The United States has not made a practice, as have European governments, of borrowing from its citizens at large. This form of investment is, therefore, something entirely new to the people. Larger sums have been raised in Europe during the war, when the amount to be allotted was limited only by the total subscription. But no European war loan for a fixed amount has yet been oversubscribed, and this fact is further emphasized by the consideration that the price of this loan—a 3½ per cent. issue at par—is by far the most favorable which has been obtained by any belligerent since the war began.

These auguries of future assistance to the Allied Powers are supplemented by the fact that Americans under their own flag are already, if in a small way, aiding on the western front. The first of such bodies to be organized were certain truck train units made up of volunteers from the American Ambulance Service in France. These units are now employed in the advanced supply service of the Frnch armies and are operating under the direction of the French staff.

The sanitary service of our allies has also been augmented appreciably. Personnel and supplies for several field hospitals, as well as numbers of additional surgeons, have arrived in England and France from the United States. This sanitary personnel has been supplied in part by the military service and in part by the American Red Cross. Several of the Allies' hospitals have been completely turned over to American control.

During the month more than one hundred American aviators have arrived in France for final training. According to present plans the famous Lafayette Escadrille will remain as part of the French Army, but additional squadrons to be organized from aviators now receiving instruction will be purely American units. Apropos of this subject, it appears not improbable that a very material part of the aid to be given by the United States toward the prosecution of the war may be in the realm of aeronautics. Tentative proposals have been made for the immediate provision of 6000 aviators and 18000 machines, with subsequent augmentation. It is believed that with such an addition to the Allied air service the Germans can be completely driven from the air and deprived of that aerial reconnaissance so essential to modern warfare.

Major-General John J. Pershing, who has been selected to lead the armies of the United States in France, arrived in England on June 8 with his staff and attached officers to a total number of about 125. After a few days spent in the exchange of international courtesies, the party proceeded to Paris and began at once to make preparations for the care of the expeditionary forces to come.

Within two weeks of General Pershing's arrival in France came the news of the safe landing in that country of the first expedition of fighting troops—a force of Regulars under the command of Major General William L. Sibert. The safe arrival of these troops is a matter for great satisfaction, giving evidence as it does that, contrary to the German claims, their submarines will be unable to prevent our sending forces to France. The crossing was not without incident, the transports being attacked by submarine flotillas on two different occasions, as described at greater length later in this review under Naval Operations. That the enemy's attempts were totally frustrated is to be ascribed to the splendid work of of the naval escort. The complete success of this first expedition is a matter for sincere congratulation to those charged with its planning and execution. Quantities of supplies for the American troops had been landed in France prior to their arrival and several freighters carrying additional supplies accompanied the convoys.

The success or failure of the German submarine campaign is still indeterminate. In four months from its opening on Feb 17, the tonnage sunk is estimated at about 1,200,000 tons, or about one-fourth of the rate of 1,000,000 tons per month that was announced as the anticipated result. This is just short of the total tonnage added to the world's merchant marine in 1916. While this loss is serious to the Allies, the number of sinkings must be materially increased if the campaign is to prove decisive before the American ship building project begins to produce

its effect. The number of vessels sunk during June is somewhat greater than during the preceding month, but is still not disastrous. At even the present rate, however, the Allies will before long have difficulty in securing bottoms for their absolutely essential sea-borne traffic and may well be reduced to serious straits before they can secure relief.

On the western front, the fighting during the month has definitely favored the Allies. The British have scored marked successes south of Ypres and at Lens. The French, remaining on the defensive with few exceptions, have inflicted severe losses upon the Germans, who launched a number of heavy attacks upon the French lines, especially at Verdun and in the Chemin des Dames sector, but without sufficient success to justify their casualties.

The situation in Russia changed very little during the month. At some few places portions of the army showed an inclination to drop their recent apathy, but there seemed to be little improvement in internal conditions. How much, if any, assistance may be expected from the Eastern ally is still a moot question.

The abdication of King Constantine of Greece removes a constant irritation and source of possible danger to the Allies, and may lead to important happenings in that region. On the whole the news of the month brings considerable comfort to supporters of the Allies. The most serious set back they have suffered is the definite halting of the Italian Carso offensive by the Austrian counterattack.

German official casualty lists as recently reported in this country bring their total losses to the end of May to the following figures: Killed and died of wounds or sickness, 1,068,127; prisoners and missing, 557,410; wounded, 2,731,223; total, 4,356,760.

On the evening of June 5, sixteen German airplanes made a raid on the Essex coast and the naval establishments in the Medway. London reports a certain amount of damage to private property but states that the injuries to governmental establishments were negligible. Twelve persons were killed and thirty-six injured. "Four German airplanes were shot down and four others were driven down by British airmen, and two of these, it is believed, were put out of action."

"A fleet of fifteen German airplanes bombarded London on June 13, killing 104 men, women and children, and wounding 403." The Germans were over the city less than thirty minutes. They were fired upon by the anti-aircraft guns and were attacked by fleets of British planes. One of the enemy machines was brought down. No military damage was done, but the property loss was very great.

The British people and press have begun a campaign to force the government to adopt a policy of reprisals for German air raids. Such a course has been urged by a few people since the beginning of the German raids on England. Of late, however, the demand has become widespread and is being voiced by some of the most eminent men in the country. The government will soon be forced to at least give some consideration to the subject.

July

The news of the past month has been somewhat less satisfactory to supporters of the Allied cause than was that of the period immediately preceding. The happenings of the month of June were practically all favorable to the Allies. The British were markedly successful in their offensives south of Ypres and in the vicinity of Lens. The French maintained their lines and inflicted severe losses on the Germans who attacked them. Conditions in Russia began to give promise of taking a turn for the better; while the situation in Greece was cleared up by the abdication of King Constantine.

The events of July have been rather less auspicious. The British offensive movements came to an end the first part of the month, from which time until the 31st nothing but minor operations were attempted. In fact, until the last day, the principal happening of the month on the British front was the German success in taking a mile of trenches at the mouth of the Yser. There has been no appreciable change in conditions on the French front. The Germans continued their fierce attacks on the French positions but with only unimportant gains and at the cost of heavy losses.

The great surprise of the month came on the Eastern front. The Russian offensive launched on July 1 bade fair, for the first two weeks, to carry everything before it. The Austrians appeared routed and the Russians were advancing rapidly into Galicia. Suddenly conditions were reversed. German and Austrian reinforcements began a counter-offensive which soon forced the abandonment of all the ground gained and of much more. The most disquieting feature of the reverse lies in the fact that large bodies of Russian troops refused to obey orders or to make any attempt to fight. Whole divisions left their positions in the line and marched to the rear, declining to oppose the advance of the enemy. At the close of the month conditions appeared to have improved slightly. A stiffer resistance was being developed but the movement had not yet been brought to an end.

The internal political situation in Russia is still chaotic. Various factions, particularly the Maximalist groups and followers of the radical Lenine, kept up constant disturbances thruout the month. Altho none of these demonstrations assumed more than minor proportions and were all quickly quelled by the government, they served to keep affairs in a turmoil and to divert much of the attention of the authorities from the settlement of vital questions. To add to the difficulties of the Provisional Government, two important sections of the country declared a more or less complete severance of their relations with Petrograd. The Finnish Parliament passed resolutions announcing the independence of Finland, while a congress assembled at Kiev decided to demand an autonomous government for

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Ukraine, which comprises the southwestern part of European Russia, including some of the richest land in the country.

On July 15 five of the Ministers of the Provisional Government resigned, the immediate cause being the Ukrainian question. They were followed shortly by the Premier, Prince Lvoff, who has been looked upon with suspicion by many of the leaders of the revolution on account of his aristocratic birth. The Socialist Minister of War, Kerensky, thought to be the strongest personality in Russia, was chosen as the new Premier. His Cabinet, announced on the 24th, consists of five Socialists and seven non-Socialists. Kerensky retains for himself the portfolios of War and Marine as well as that of Premier. In the meantime, the Councils of Soldiers' and Sailors' and of Peasants' Delegates accorded to Kerensky's government unlimited and dictatorial powers on account of the debacle in Galicia. The Premier has announced that the sternest measures will be taken to recall the army and the country at large to their duty. How well he will succeed in his attempts remains yet to be seen.

The Central Powers have not been without their internal difficulties. Austria has at no time been whole-heartedly in the war. A large proportion of her heterogeneous population has been actively opposed to the war since the beginning. Some of her people are pro-Ally, and many more are anti-German. With the passage of time, the agitation for peace has grown continually stronger. Reports of serious uprisings in various parts of the country have leaked out from time to time. It is an open secret that the Austrian government is anxious for peace on any reasonable terms.

Now Germany itself is feeling the effect of agitation from within. Strikes and food-riots have been rife for some time. There has also been a growing demand for certain internal reforms and for a statement of peace terms looking toward an attempt to end the war. This movement finally culminated in a serious effort in the Reichstag to force the government to accede to the demands of the people, and to adopt the Socialist platform of "no annexation and no indemnities." The agitation developed such strength that the government could not ignore it. Certain of the political reforms demanded have been promised, but most of them are to be effective after the termination of the war, which is far from satisfactory to their proponents. As regards the publication of peace terms, the government was immovable. Chancellor von Bethmann Hollweg was quoted as saying in a speech on the subject, "I repeat that the formula of peace without annexation is unacceptable to us. We cannot declare our terms of peace. We must fight and conquer."

On July 13 the Reichstag passed a resolution calling for no forced acquisitions of territory, no political or financial violations, and no economic embargo after the war. The vote on this resolution was 214 to 116, showing definitely for the first time the strength of the new Opposition. The next day Chancellor von Bethmann Hollweg, Foreign Secretary Zimmermann and Secretary of the Interior Helfferich resigned their portfolios. Dr. Georg Michaelis, a minor Prussian official and a bureaucrat of the old school, was selected as the new Chancellor. Tho Michaelis, in formulating his program, endeavored to satisfy all the different factions, it is believed that the change, in which the Crown Prince was largely instrumental, holds forth little promise of any material alteration in the present policies of the Empire. The Reichstag adjourned on July 20 to reassemble Sept. 26, when a renewal of the attack on the government is anticipated.

The United States continued during the month its preparation for an active participation in the war. On the 15th there began the mobilization of the bulk of the National Guard not already in the Federal service. The drawing of numbers to determine the order of calling to the colors the men drafted for the National Army took place in Washington on the 20th and 21st. By the end of the month a start had been made in examining those drafted. This work will continue uninterruptedly until the total number for the first draft has been secured. The American expeditionary force in France was reinforced during the month, the first arrivals being moved to advanced training camps where they are receiving instruction in the latest developments of trench fighting.

The weekly rate of merchant vessels sunk by submarines was smaller in July than in any month since the beginning of the campaign. This, coupled with the favorable aspect of the Allied building programs, is distinctly encouraging. The American ship-building board has been reorganized and gives promise of materially increasing the rate of vessel construction in the yards of this country. The British Premier has announced that Great Britain will this year turn out four times as many ships as in 1916. The danger of the success of the German submarine compaign is becoming constantly less threatening.

German airmen made three raids on England in July. On the 4th a fleet of twelve or more airplanes bombarded the Essex port of Harwich. Eleven persons were killed and thirty-six injured. Two of the raiders were brought down. Three days later twenty-two special bombing planes with a large protecting squadron made an attack on London, in the course of which there were 43 killed and 197 injured. Three of the bombers and six of the accompanying fighting machines were brought down by the defending airplanes and anti-aircraft guns. A third raid was made by daylight on July 22, when some twenty airplanes attacked Harwich and Felixstowe but were soon driven off after inflicting casualties numbering 11 killed and 26 injured. The raiders were met off the Belgian coast by a patrol of British machines and one of them was brought down. In all of these raids the material damage was insignificant. It was announced in the House of Commons on July 21 that the British government had decided to adopt a policy of retaliation on Germany for the air raids on England. So far this

plan has not been carried out, tho there has been extensive bombing on points of military importance close behind the German lines.

A statement given out on July 5 by Major General F. B. Maurice, Director of Military Operations of the British War Office, contains some interesting figures. Since the beginning of the war the British have taken 739 German field guns and lost 133, of which 37 have been recaptured. Of this net loss of 96 guns, 84 were lost in the first months of the war. Not one gun has been lost since April, 1915. Since April 1, 1917, there have been captured from the Germans on the whole western front 509 field and heavy guns, 503 trench mortars, 1318 machines guns and 63,222 men. The British have taken a total of 117,776 German prisoners since the war began and have lost 51,088 including Indian and native troops.

August

After the rather discouraging happenings of July, the events of the past month have been particularly gratifying. During August the preponderance of successes inclined definitely toward the side of the Allies. It is true that on the eastern front the cessation of the Russian retirement is negatived in that it is apparently due to the fact that the Germans have stopped their pursuit rather than that the Russians have recovered from their disorganization. In fact the disorganization seems to have spread, as a considerable section of territory in the vicinity of Riga, hundreds of miles north of the scene of the former debacle, was abandoned to the Germans almost without opposition. In Rumania, also, General Mackensen met with some success, tho his movement has now been stopped, at least temporarily.

On the western front, however, the Allies have been markedly successful in three independent and widely separated offensives in France, while the Italians have made important gains in a new advance on the Isonzo front. The Allied offensive in Flanders, begun on July 31, has been continued intermittently thruout August with some very material successes. The Canadians have closed in on Lens until they occupy a few points in the edge of the town itself. The third section of Allied activity was north of Verdun, where there has been relative quiet since the French blow of last December. Profiting by the attention of the Germans being centered elsewhere, the French launched an attack on both sides of the Meuse, which has pressed the lines back almost to where they were at the beginning of the German operations a year and a half ago. The Italian offensive was started with great abruptness on a front of over thirty-five miles from Tolmino to the Adriatic, and has already scored important successes. It is the most ambitious operation they have yet attempted and bids fair to be attended with the most important results.

There has been little apparent change in the internal conditions of Russia. The American mission to the new republic, headed by Mr. Elihu Root, returned to the United States during August and expressed the belief that the new government would endure and come thru its present difficulties. It was stated that the Russian people as a whole were sound, self-controlled and possessed of a great faculty for concerted action; that they were, in the main, supporting the provisional government; and that the existing somewhat chaotic condition must come to an end before long. This is encouraging news, but there is little external evidence of improvement. The agitation of the different radical groups is continuing and the condition of the army seems, if anything, worse than before. General Korniloff, the Commander-in-Chief, painted an alarming picture of the present military situation in a speech before the National Conference. He showed that the whole army was honey-combed with disorganization and lack of discipline and that it was, moreover, near the end of its supplies. He called upon the government to take the necessary steps to restore discipline by giving the officers the power of inflicting severe punishments, including the death penalty, and by the restriction of the soldiers councils, stating that otherwise the army must collapse.

The National Conference met in Moscow on Aug 26, being attended by representatives of all the different political parties and of the different elements of the population. The conference was in session for three days and is believed to have been attended with important results. Chief among these was the presentation of the wishes of the different classes of the population and the agreement among the political parties concerning the measures they would support. The government now knows at least what steps it can take with a surety of being supported.

The political agitation in Germany has continued unabated. The time of the Reichstag Main Committee during its midsummer session for the transaction of necessary business was largely taken up in acrimonious debate concerning the statement of peace terms by the government and the granting of political reforms. It is evident that the coming session of the Reichstag, which convenes at the end of September, will be a stormy and possibly momentous one, as the Opposition now outnumbers the supporters of the government by nearly two to one.

Under date of August 1, the Pope despatched to all the belligerent capitals proposals looking toward peace. Summed up, the proposals were for a peace on the basis of "status quo ante bellum," all conquests to be returned and such questions as Alsace-Lorraine, Poland, "Italia Irredenta" and similar problems to be settled by "subsequent negotiations." The Allied governments were all cold to the suggestion. On Aug 27 President Wilson made the first formal reply to the Pope's proposal, declining the offer in a note which has been widely heralded as one of the ablest state documents of recent years. The grounds for declining the proposals were that it was impossible to repose any trust in the word of the present rulers of Germany unless there was conclusive evidence that it was explicitly supported by the German people.

Less damage was inflicted upon England thru airplane raids during August than for several months. Thirty-two persons were killed and forty-three injured at Southend, Essex, on August 12. London

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was the objective of the raiders but such swarms of defending planes took the air upon the first indication of danger that the attackers were unable to get near their goal. Two of the raiders were brought down. On the night of August 21 there was an attack on the coast of Yorkshire and the next morning one in Kent. In the two, eleven persons were killed and thirteen injured. Three of the attacking planes were shot down.

The German air service has found a new use for their machines in France in the bombardment of hospitals. There have been several reports the past month of hospitals being struck by bombs, both explosive and incendiary. That these occurrences were not accidental is shown by the statement that in at least two instances the airplanes flew down to low altitudes and used their machine guns on the hospital attendants and the wounded whom they were removing from the buildings set on fire by the bombs. A number of wounded men and nurses were killed in this way.

The French Information Bureau gave out a statement on Aug 29 which contains some interesting information concerning the number of troops the Central Powers now have on the two main fronts. On the western front there are said to be 140 German divisions, over 80 of which are opposed to the part of the front held by the French. On the Russo-Rumanian front there are 137 divisions consisting of 88 German, 41 Austro-Hungarian, 4 Turkish and 4 Bulgarian divisions. Of the German troops, only twelve are active divisions, the others being made up of Landwehr and Landsturm formations. The normal German division contains 20,000 men but it is unlikely that these divisions are all at full strength. In this connection, it has been recently ascertained that most of the German class of '18 and part of the class of '19 are at the front, some of the former having been engaged for nearly a year. This is interesting in view of the fact that the French have not yet sent their class of '18 away from their training camps and have just called the '19 class to the colors. It would thus appear that the French are not as near the end of their man-power compared to their enemy as has been feared, and that the German attempt to wear France down and "bleed her white" has not met with the success that has been claimed for it.

September

To the casual observer it may well appear that the Allied operations during September show very little result compared with what was accomplished in the preceding month. Both in number of major attacks and in extent of territory captured from the enemy there was a decided decrease. There were no important actions at all in the Lens sector, where the Canadians were so successful in August. The recent gains north of Verdun were augmented very slightly during the month and that within its first few days. The British at Ypres and the Italians on the Isonzo met with more marked successes, but even at these points the areas taken compared very unfavorably in extent with what was accomplished in August.

In spite of these facts it is believed that the Allies may justly feel that they have achieved most substantial results in the past month. The importance of their gains is to be measured less in the amount of ground wrested from the enemy than in the promises of future successes which they offer.

The former British advances east of Ypres were held up by the Germans largely on account of the latters' commanding positions on the ridge which is referred to in the despatches by the name of Passchendaele, a village at its northeastern end. This height is from 125 to 200 feet high and is the last of those elevations the possession of which has given the Germans such marked advantages in former operations in Flanders. Earlier in the year the British took Vimy and Messines ridges farther south. By their successes last month they have taken a long step toward securing possession of Passchendaele ridge, the only one remaining in German hands. They are now firmly ensconced on the southern end of the ridge, holding about half of the whole, and are in a vastly better position than formerly to push on and secure the remaining portions of the height. In fact, the task of clearing the Germans from the rest of the ridge should be a simple operation compared to what has just been accomplished.

Many commenters are predicting that with the loss of this ridge the Germans will be forced to fall back along a considerable section of their front in Belgium. They will certainly be fighting under serious disadvantages if they attempt to hold their positions in this sector after the British have secured the entire ridge, as now appears probable. It has been reported that the Germans have already made preparations for a withdrawal of several miles and that they are removing the machinery from the manufacturing establishments of many Flemish towns. It is thus seen that the relatively small British gains may lead to momentous consequences.

A somewhat similar situation has arisen on the Italian front as a result of the September operations. Here the Italians have advanced very little on the Bainsizza, the scene of their major successes in August, but they have established themselves on the crest and the northern and western slopes of the commanding Mt. St. Gabriele. They have thus released Gorizia from the incessant bombardment to which it was formerly subjected, and will be enabled to assist any further movements on the Bainsizza plateau from the mountain, instead of having its influence exerted against them.

On the eastern front the Germans have consumated the capture of Riga, as was presaged by the events of the latter part of August. It does not appear, however, that the fall of this city, important sea-port and commercial center tho it is, need be considered of vital importance. Were it the German intention to continue their movement farther east, Riga would undoubtedly serve admirably as an advanced base. The

near approach of the season least fitted for extensive operations in this theater seems to preclude such an idea, however. It appears more probable that the capture was undertaken with the idea of supplying a success which might offset in the eyes of the German people, the reverses which their arms had experienced elsewhere. Certain it is that the German desire for an early separate peace with Russia has not been furthered by this step.

England was subjected to an unusual number of raids by German airplanes this month. No great amount of material damage was done by the bombing but there were numerous casualties. On the night of Sept 3 the naval station at Chatham, on the southeast coast, was bombed by six airplanes. one hundred and eight persons being killed and ninety-two injured. All but one killed and six injured were sailors on duty at the station. The next night twenty planes attacked London. The raid lasted about one hour and a quarter and forty bombs were dropped, resulting in the death of eleven persons and the injury of sixty-two. Both of these attacks were made by bright moonlight, but a slight haze prevented the raiders from being seen.

London and the eastern counties of England were again raided on the nights of Sept 24 and 25. As a result of the first raid fifteen persons were killed and seventy persons injured. The raid on the 25th resulted in some twenty casualties. Another attack was delivered against points on the coast of Suffolk, Essex, and Kent on the evening of Sept 28. Some of the raiding machines tried to reach London but they were all driven off, two of the raiders being brought down. No casualties were reported.

The next night, the 29th, twenty airplanes participated in still another raid, advancing in small groups in an effort to penetrate the aerial defense. Only a few of them got thru to London, the remainder being turned back when they reached the coast. Two machines were brought down. On the night of the 30th another attack on London resulted in the death of nine persons and the injury of forty-two. Two raiders were destroyed and a third shot down and captured.

Some approximate figures showing the present status of Germany's man power were presented in an Associated Press despatch from the French Grand Headquarters under date of Sept 9. According to this statement, there are now on the various fronts, on the lines of communication, and stationed in the interior, 5,000,000 men; in depots, etc., 600,000; under treatment in hospitals, 500,000. With a total of 4,000,000 men killed, permanently disabled and prisoners, this would make 10,600,000 mobilized since the beginning of the war. It is estimated that the total mobilizable male resources of the Empire from the beginning to include the class of 1920 number about 14,000,0000. Counting 500,000 employed in indispensable pursuits, 200,000 abroad and unable to reach Germany and 2,100,000 exempt owing to physical disability, there are left only 600,000 recruits available in the immediate future. These figures, while only approximate, must represent the actual situation with a fair degree of accuracy.

General Sir William Robertson, chief of the British General Staff, gave out some brief but interesting statistics on Sept 29. It was stated that during 1917 the British have captured more Germans and four times as many guns as the Germans have taken from the British during the whole war. He showed that the British losses had grown lighter, both relatively and actually, while the German losses had grown heavier. The British supply of materials has been so increased that the preponderance is now definitely in their favor instead of in their enemy's. Also the British are equipped with the best possible material, while the Germans, due to their diminishing resources, must be content with less perfect equipment.

The French have also issued a somewhat similar tho less detailed statement, showing that they consider themselves in much better condition relatively than at any previous time during the war.

October

October has witnessed, in the overwhelming defeat suffered by the Italians, the most serious reverse which the Allies have experienced in many months. The Italians seemed in a fair way to secure a most decisive advantage in their campaign against the Austrians. An advance of less than five miles from their position on the Bainsizza plateau would reach the insurmountable Julian Alps, completely severing connection between the wings of the Austrian army. The danger to the Austrians, and consequently to the Central Powers as a whole, was so acute that Germany could no longer afford to keep out of the Italian theater. Concentrating an enormous number of guns and a large army on a short sector of the line, preparations were made to put an end to the threatening situation.

Their plan was simplicity itself—to bring an overwhelming force to bear on a short front, to break thru, and then to threaten the rear of the rest of the enemy's line, forcing it to fall back. The plan was admirably executed and met with extraordinary success. The Italians were forced to abandon their positions on the whole Isonzo front—an extent of some sixty miles, from the Carnic Alps to the Adriatic—and to retreat rapidly across the plains of Venetia. As the month closed there was no surety that the retreat was at an end, tho an attempt was being made to stop the pursuers at the line of the Tagliamento River, while the French and English were rushing aid to their defeated ally. Thus quickly has Italy been thrust from a position in which she might render most important assistance to the Allied cause into one in which she must herself be assisted.

On the western front in France and Belgium matters have been progressing more favorably. The Ypres offensive continued to gain during October and the French scored a brilliant success southwest of Laon. It has been argued by some that, since Germany must eventually be defeated on the western front, reverses elsewhere need not be worried about so long

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as the situation there is satisfactory. This argument has something to commend it but is specious none the less. The more fronts on which the Central Powers can be engaged, the less attention they can devote to the important western front. This is axiomatic. With the Russian front quiescent and the Italians now so severely punished that they can not become dangerous for some time at least, the Western Powers will have a most difficult task ahead of them.

The number of merchant vessels sunk by submarines was again low during October. Possibly more conclusive than the published reports of the lessened danger from submarines is the recent action of the United States Government in lowering the insurance rate on vessels in the trans-Atlantic trade. It was announced on Oct 6th that the War Risk Insurance Bureau of the Treasury Department had reduced the rate on these vessels from 6½ to 5 per cent, a decrease of nearly 25 per cent. It was stated that "This reduction is made because of the corresponding decrease in the risk." This action seems to indicate a belief on the part of the government that the submarine activities have passed their zenith.

It appears that the German people themselves are beginning to have doubts of the efficacy as well as the wisdom of the submarine campaign. Articles expressing such belief have recently appeared in several German publications and there have been a number of speeches before the Reichstag advocating its abandonment.

Only one air raid of consequence was made on England during October. On Oct 19th seven Zeppelins bombed London with a resultant loss of thirty-four lives. Four of the aircraft were brought down by French guns and airplanes on their homeward journey. Two others apparently lost their way and sailed south across France, passing above Marseilles. At least one of these was evidently lost as French aviators reported that a Zeppelin sank in the Mediterranean on the night of Oct 20.

November

The month just closed has been a very favorable one to the Allies from a purely military standpoint. Probably the event of the most immediate importance is the arresting of the invasion of Italy. The Austro-German main forces have been stopped at the line of the Piave River, while their attempt to turn that position by attacking from the north has been checked, at least temporarily. French and British reinforcements have come upon the scene and it is to be hoped that the worst is now over in this theater.

In the early part of the month the British completed the conquest of the northern end of Passchendaele Ridge. With this success the advantage in observation in Flanders passed definitely into their hands. From now on the Germans in Belgium and northern France will be laboring under the difficulty of having their enemies on the high ground while they occupy the lower country. Heretofore this condition has been reversed. This change in the relative positions of the contending forces has been the principal result of the various British successes this year.

Before it became evident that they had stopped their operations in the Ypres sector, and indeed while they were in the midst of a violent bombardment there, as tho in preparation for a resumption of the attack, the British opened a new offensive south of Arras in the direction of Cambrai. By adopting new tactical methods, daringly conceived and brilliantly executed, they secured in two days' advance a greater extent of territory than either belligerent has heretofore achieved on the western front. The usual artillery preparation was dispensed with. The brunt of the opening attack was borne by an unusual number of tanks. These were followed by the infantry and even by bodies of cavalry, who rendered great assistance in rear of the German defenses when a way had been broken thru for them. Over ten thousand prisoners were taken by the British, which exceeds the total of their own casualties.

The latest political events in Russia are such as to give grave concern to the Western Allies. The rise to power of the Bolsheviki brings to the fore a number of men who have been freely proclaimed as German agents. Their first governmental move, the opening of negotiations for an armistice looking to the consummation of an early peace, is not one to inspire much hope for the future. Should the Bolsheviki have their way, the Western Allies may soon find in their front the whole strength of the Central Powers, greatly increasing the magnitude of their task.

Recognizing the necessity for closer co-operation in future plans for carrying on the war, a permanent inter-Allied Military Committee has been formed. The Premiers of the several countries together with one official of each War Council make up the Committee, with military delegates attached in an advisory capacity. France is to be represented on the joint board by General Foch, Chief of Staff of the War Ministry, and Great Britain by General Wilson, Assistant Chief of the British General Staff. The Italian representative is General Cadorna, who has been in supreme command of the Italian armies since the beginning of the war. General Cadorna has been succeeded in active command of the Italian forces by General Diaz, with Generals Badoglio and Giardino second and third in command respectively.

The American Expeditionary force in France has suffered its first casualties in combat. In connection with their training for active duty, American battalions have recently been sent into the trenches to get actual experience in trench life. Early on the morning of Nov 3 a German trench raid struck a part of the line they were holding. All the occupants of the short section of trench involved were killed, wounded or captured. Slight as the incident was, it is of interest as marking the first contact of our troops with the enemy. To offset this first reverse an American reconnoitering party ambushed a German patrol on the night of Nov 14.

THE WESTERN THEATER

Hardly had the German peace proposal been made, when, as if in answer to it, there followed another sharp thrust by the French at Verdun. Matters had been practically at a standstill here since the termination of the previous French advance in October. This new effort was directed by Gen. Nivelle, before leaving Verdun to assume his larger command. After an artillery preparation lasting 70 hours, four French divisions advanced at 10:00 a. m. on Dec 15, over a seven mile front directly east of the Meuse. The enemy's line was broken thru, Paris reported, to a depth of about 2 miles all along the front. The new French line, on the 16th, extended from Vacherauville on the Meuse east past Pepper Hill, thru Louvemont and the Chambrettes farm to the village of Bezouvaux. Heavy German counter-attacks on the 17th and 18th failed to alter this alignment materially. On Dec 18, Paris announced the capture of a total of over 11,000 prisoners during this offensive.

Elsewhere on the western front, no major attacks have been made. Trench raids, local skirmishes, mining operations—these make up the story of the daily reports. Serious fighting is generally thought to be over for the season on the Somme. While the Anglo-French effort to pierce the German lines has been blocked, there is much of encouragement to the Allies in this campaign. Some 90,000 German prisoners are claimed to have been taken, and the strain upon German resources in munitions and men must have been great. In this struggle, too, the new British Army appears to have found itself. They failed in their early battles, not thru lack of courage, but from lack of co-ordination, thru the mistakes and inexperience of their officers. But the improvement has been marked. Today Britain has in France some million and a half of men; and tho her losses have exceeded 600,000, her army is approaching a state where it will be more ready and equal to its task.

January

The winter on the western front has been characterized by a greater degree of activity than that of a year ago. At that time the German losses shrank to about one-fifth of those of the more open months. In accordance with their avowed policy of attrition, the Allies have evidently decided to keep up the pressure as far as practicable, by means of artillery bombardments, raids, and patrol actions. From Ypres to the Somme, British activity has been increasing in this respect, many of the raids being made in strength, and preceded by heavy artillery preparation. For their part, the French have co-operated in this method of warfare, and raids have been reported in the Vosges in the Champagne, and elsewhere. The Germans make little use of such tactics, and spare their men as far as possible; for one thing, such movements as these by small units are perhaps better adapted to the individual initiative of the Entente soldier.

The French have been elated over the success of their November and December assaults at Verdun. Nevertheless, the Germans are exhibiting a "die-hard" spirit in this sector. After trying with little success to force the new French line east of the Meuse, their attack suddenly shifted west of the river. Several regiments were sent against the long-contested positions on Dead Man's Hill and Hill 304 (Dec 28), and over a two-mile front, succeeded in piercing to the third line trenches. Some 200 prisoners were taken. The artillery preparations was accompanied by a heavy rain of bombs, to such good effect that the bomb-throwers were mentioned in the official accounts. The Germans are now farther advanced than ever before in this particular neighborhood.

Operations on the Somme have been of the character already described. No noteworthy advances have been made, altho some slight additional gains were made by the British in the Ancre valley, in the fighting from Jan 12 to Jan 17. Little has been heard recently of the tanks, altho numerous published photographs have served to clear up the mystery at first surrounding them. Their field has so far been confined, apparently, to accompanying an infantry attack after the silencing of the hostile artillery; and there has been little call for such assistance of late.

After a period of comparative quiet the air services have become once more active, and numerous air raids are being reported.

It was noted that there was a lull "almost everywhere" in the artillery bombardments on Christmas eve.

February

"Indications are pointing to the west rather than the east as the scene of the titanic struggle which is expected to decide the war. The German troops which were employed in the conquest of Rumania are being transported west."

This opinion, which seems to be gaining ground, despite von Hindenburg's known predilection for the eastern front, is based upon the developments of the last month. England, in opening again the battle on the Somme, has given evidence that she intends to press her offensive here with fresh determination. The cessation of German efforts in Rumania and the Baltic region, the heavy military traffic reported over German railroads, and the considerable German offensive in Champagne, all indicate that German high command is not disposed to adopt a merely defensive attitude on the western front.

On the Somme sector, operations have for the most part been confined to the northern front of the salient. All along the line, from Serre to Sailly-Sallisel, the British have advanced their trenches somewhat, especially on the west, where the average gain (up to Feb 12) was ¾ mile over a 3-mile front. The Germans showed a disposition to retreat without the extremely stubborn resistance that characterized the earlier advances in this region. A gain near Transloy, on Jan 27, was followed by several advances in the Beaucourt-Grandcourt area, culminating on Feb 7 with the occupation of the latter village. The following week, the pressure in this direction was increased, and the British lines were advanced dangerously close to Serre, which had been the object of an unsuccessful attack in January. Finally, on Feb 17, another advance up the Ancre penetrated the hostile lines 1000

EUROPEAN WAR—Continued

yards, and gained a position north of the river, opposite the town of Miraumont. Nearly 800 prisoners were taken that day. Meanwhile, other successes had been gained farther east, near Le Sars, the nearest point to Bapaume, north of Gueudecourt, and at the apex of the salient, where the capture of a hill near Sailly-Sallisel marks the first change in this sector since last fall.

The struggle at Verdun was reopened by the Germans on Jan 25, when General von François attacked Hill 304, west of the Meuse, continuing the offensive of Dec 28. The French estimated that six German divisions were engaged.

"A short but intense artillery preparation was followed by an infantry assault designed to gain the objective in a single rapid operation. Berlin on Jan 26 announced that this assault, carried out by Westphalian and Baden troops, had won some 1700 yards of trench front on Hill 304, and had captured 500 prisoners and ten machine guns from the French."

Reports disagree as to the success of the French counter-offensives undertaken on the succeeding days.

The main German effort of the month was made on the old Champagne battlefield. The *Army and Navy Journal* thus describes this conflict:

"The operation in Champagne, by which a rapid co-operation of German artillery and infantry, according to Berlin reports, overcame and captured French defenses on a front of 2600 yards to a depth of over 800 yards took place, on Feb 15, in the portion of the line lying south of Ripont and between Tahure and Maisons de Champagne. The execution of this blow, tho on a smaller scale, belonged to the same order as those of October and December, inflicted by the French at Verdun. The bombardment, according to details supplied by the German semi-official news agency, began at dawn. The French trenches were leveled and the French artillery silenced with great rapidity. The German infantry attack following hard on the artillery preparation, pushed thru the remnants of four successive lines of defense, encountering scattered but stubborn resistance. The German assertion is that barbed wire barriers had been systematically swept away by the artillery, and dugouts penetrated by heavy shells in such a way as to minimize the resistance and cause the surrender of many small isolated groups of the French, cut off or penned in underground refuges. The prisoners numbered twenty-one officers and 837 men with twenty machine guns. Berlin further reports the repulse of a French counter-attack on the evening of the 15th and of another the following morning, but later activities on both sides seem to have been confined thruout the week to artillery."

In addition to these larger operations, ceaseless raiding has continued during the month, all along the western front. The cost of these operations is reflected in the British casualty list of 32,000 for January, a month when practically no large operations were undertaken. "Undoubtedly these raids," comments the *Army and Navy Journal*, "while without great effect on the opposing lines, have the effect of building up confidence and aggressiveness in the ranks of the somewhat less seasoned British force, while they cause some hardship and loss to the numerically inferior Germans. . . . The maintenance of the policy of continual raiding of the German lines is likely to find its reflection quite as much in German as in British wastage, and undoubtedly indicates the British purpose to exchange losses, man for man, so far as possible with an opponent numerically inferior."

The French have displayed little initiative during the month, except that their artillery has been active, and their air-squadrons are resuming their raids in rear of the German lines. General Nivelle paid a visit, about the 1st of February, to the Italian front.

A resumption of aerial activity is increasingly evident. The British advances have forced the Germans to fresh exertions in this direction, and many German planes have been brought down while endeavoring to reconnoiter behind the English lines.

March

In February we saw that General Haig had chosen to renew the conflict on the ground where it had left off in the fall. By the third week of February a deep wedge had been driven up the Ancre valley, piercing the German lines as far as Miraumont, threatening from the rear the town of Serre, whose successive tiers of trenches had held firm since the beginning of the Somme operations. These advances were made by troops of the Fourth British Army under General Gough.

The German plans for the next development had been laid for some time. On Feb 22, British troops advancing from Gueudecourt found that the Germans were no longer in their immediate front! Other advances confirmed the suspicion that the Germans were retiring over a considerable line. Cautiously the British advance continued, meeting with scant opposition, except from the handful of men left to harass their progress. The German withdrawal had been made deliberately, leisurely, after careful preparations. Everywhere supplies and equipment were found to have been removed, and traps of various kinds laid for the pursuers. Mines and spring-guns were left set in the empty fortifications; even an innocent German helmet might conceal a sensitive bomb.

By the end of February, the full extent of this withdrawal was disclosed, and the British had developed the new position, running from Hennescamp straight southeast to Le Transloy. The strip of territory thus relinquished was eleven miles long, some two and a half miles deep; it trimmed squarely off the salient threatened by the British advance up the Ancre. The new position, on higher ground, still lay a mile in front of Bapaume, the immediate objective of the British, and seemed stronger than the old. Despite the moral advantage of having advanced, the English were hardly able to attach more than local importance to this skillfully planned and admirably conducted retreat, except perhaps as it presaged a more extensive retirement.

It was not until Mar 9 that the British were able to resume their offensive in the Somme sector. During

the intervening ten days they had been organizing the new strip of territory (which they found a "horrible quagmire") and bringing up their artillery. The village of Irles was the next objective, and its easy capture aroused the suspicion that the new line was merely a screen to cover further retirement. On the 12th, advancing northeast from Irles under cover of their freshly posted guns, the British found a three-mile front of the German position deserted, and passed thru Loupard Wood to within two miles of Bapaume. During the succeeding days their lines crept forward still closer to that city on the south and west. Elsewhere (in particular north of Peronne, where they had essayed an attack toward Bouchavesnes) they made little progress.

It was on Mar 15 that the general German retirement fairly began, and Allied advances, which for two years and more had been measured in yards, were now counted in miles. Bapaume was entered on Mar 16, after a rear-guard engagement, and then village after village—40 in the first week—were occupied by the advancing British. Péronne, hitherto invincible, was entered on the 18th. On the 19th, the English cavalry was sent out, and the pursuit continued, in the face of a heavy rainstorm.

The French advance was a shade later in starting, but once the way was found clear and a general forward movement began on Mar 17, the rate of progress outstripped that of the English farther north. This may have been due to superior mobility on the part of the French, or to the somewhat more hasty retirement of the Germans in this sector. By the 20th, French cavalry columns had pursued the retiring troops within five miles of St. Quentin, while the next day another French force came close upon La Fère. Two main lines of advance could be discerned from the despatches —one from Lassigny thru Ham toward St. Quentin, another which occupied Noyon, the chief city of the evacuated territory—then moved thru Chauny up the Oise toward La Fère. In the neighborhood of Soissons, at the south end of the line, the French advance against the dominating German positions was more cautious. Occupying the first German line on Mar 18, they continued north and east toward the extensive forests of Coucy-le-Chateau.

After the first surprising days of uncontested advance, the character of the fighting changed materially. German resistance stiffened, and each successive Allied advance was more sharply contested. But the old trench warfare, for the moment, at least, had been discarded. Mobile tactics had come to their own once more, infantry found scope for maneuvering, the field artillery came into play, and large masses of cavalry were used as intensively as if to make up for their idleness of two years. "This outcome," comments the *Army and Navy Journal,* "vindicates the organizing judgment of the Entente side, which has consistently acted on the belief that mobile warfare was bound to recur before the end of hostilities."

General Nivelle's forces continued their aggressive tactics, as they came in closer contact with the Germans, and by a rapid series of attacks strove to break down the hostile positions. Particularly did they press their advance south of St. Quentin, where they succeeded in driving a wedge into the German line. (Directly west of this city is the dividing point between French and English forces.) At La Fère they found their progress blocked by an inundated area; the Germans had dammed the Oise and the Serre at their junction point in order to protect this town. Still farther to the south, the forests of Coucy presented a barrier which the French took some days to turn. German attacks at more than one point succeeded in delaying or checking the French moves.

The English, for their part, were meeting with stubborn resistance in their slower advance at the north end of the line. Six miles from Bapaume, on the highway to Cambrai, lies Beaumetz. For days the fighting centered about this village, which changed hands several times. The progress of the British troops, tho slow, was well maintained, and by the end of the month they were fairly aligned with their neighbors on the right.

The occupied territory is a strip some sixty-five miles long and twenty-five miles deep at its widest part. It comprises over 1000 square miles, or about one-eighth the total French territory overrun by the Germans. This entire area was systematically and ruthlessly devastated before the German retirement—roads, railroads, wells, depots destroyed, even whole cities deliberately wiped out. While the destruction was perhaps no more complete than that in the Shenandoah Valley during the Civil War, there are reported instances of wanton cruelty and malice that the plea of military necessity can hardly excuse. The strength of the fortifications abandoned is said to have amazed the British who entered them.

The retreat itself was admirably handled, involving, as it did, the withdrawal of an army of several hundred thousand men, with a minimum of loss and without any great disaster. The German method of covering their retreats is described as being essentially different from that of the Allies. Instead of employing rear-guards of cavalry for their purpose, as do the latter, the Germans appear to leave a thin screen of infantry, their weakest troops with their poorest equipment of machine guns and other weapons, to be sacrificed, if necessary, in order that the fittest may get safely away.

While their unwonted retirement was going on, the Germans multiplied their minor attacks elsewhere on the western front, as if to feint the beginning of a new offensive. Such a move, however, there has been no good reason to expect on this front. Among the several attacks directed at the old Verdun positions, those of Mar 3 and 4 were reported as moderately successful, measured in prisoners and trenches taken. The French achieved a noteworthy success on Mar 8, when a lively attack in the region east of Tahure virtually won back the position, some half mile deep, gained by the Germans in their attack of Feb 15. This gain was disputed during several days of undecisive fighting. The numerous other actions, all along the line, call for no

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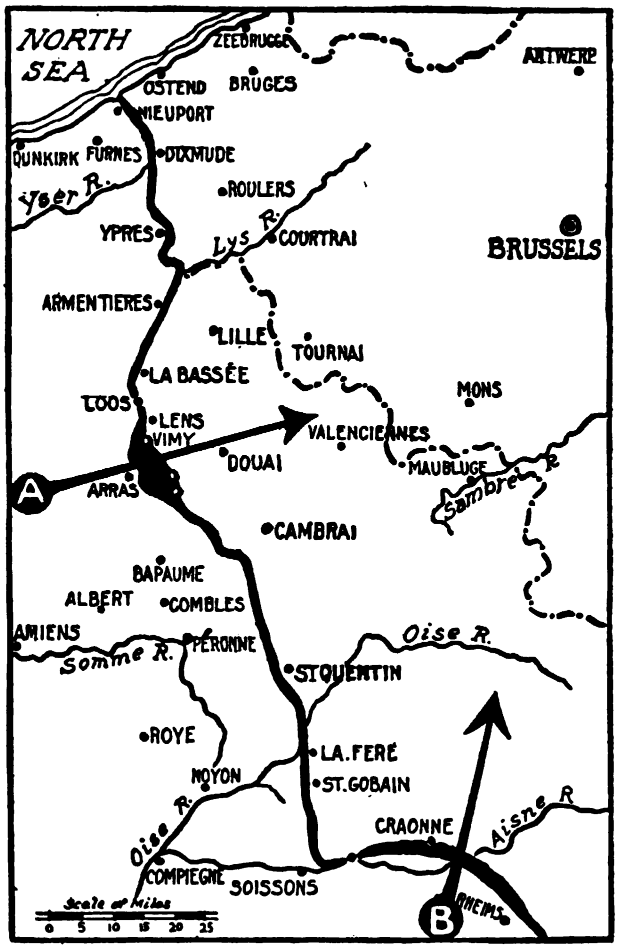
special mention. They were of the usual character and involved heavy losses. Sixteen English airplanes were reported to have been accounted for in one day by the Germans.

April

At the beginning of April the Germans stood on what had been called the Hindenburg Line, a position which they had had every chance to make a formidable one. Fairly in the line were the fortified towns of St. Quentin and La Fère, while some miles behind and guarding the two flanks lay Douai on the north and Laon on the south. Up to this line the German retreat had been conducted in masterly fashion; the British reports claimed a capture of only 1200 prisoners for the entire month of March.

The French and English were now fairly up to the supposed line where a vigorous resistance was to be expected. But they did not stop there. Gradually, in the first days of April, the Allies pushed closer to St. Quentin, the British on the west, where they took Savy, the French to the south and east as far as Moy on the Oise, together forming a half-circle barely two miles from the town. Meanwhile, the English farther north, who were now outstripping the French in their advance, were vigorously striking along the Bapaume-Cambrai highway. Their capture on Apr 2 of Croisilles, a strong village close to Arras, was also noteworthy. In all this fighting, the firm resistance characteristic of trench warfare was lacking; nor did the Germans respond to the Allied attacks with the sharp counters that might have been employed. Signs multiplied, during this period, to indicate that the Germans occupied, rather than a single definite line, a series of echeloned positions, "switch lines," as they have been called, which would enable them to make further gradual retirements.



The great British drive was preceded on Apr 5-6 by unwonted aerial activity. A huge fleet of airplanes, operating far in rear of the German lines, secured 1700 photographs of the hostile terrain (at an admitted cost of 28 airplanes). This was succeeded by a heavy bombardment of two days, which reached its maximum intensity on Easter night (Apr 8). Soon after dawn the assaulting lines swept forward along the eleven-mile front from Givenchy to Henin. The Canadians occupied the left of the line, the British the right and center.

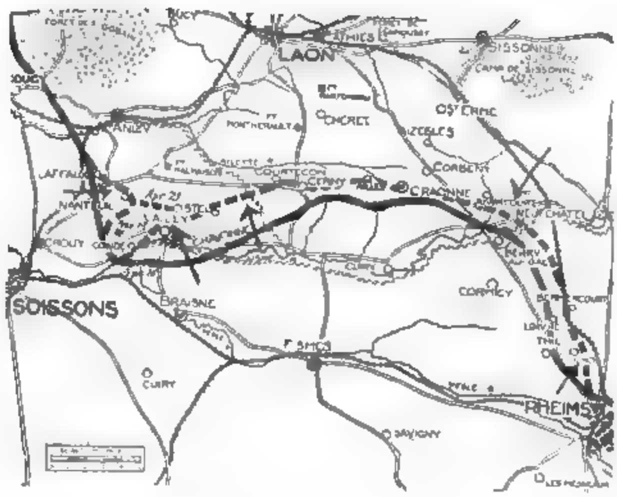
Opposite the Canadian troops lay the formidable Vimy Ridge, dominating all this section and culminating at its north end in Hill 140, some 500 feet high. Covered by the effective barrage fire of their artillery, the Canadian went straight to the crest, a mile away, thru several lines of intervening trenches. Within a few hours they were masters of the ridge, except Hill 140, which resisted their attacks for three days. This brilliant feat cost the Canadians over 5000 men. Meanwhile, the British had pushed east from Arras, on both sides the Scarpe, where no such strong position as Vimy Ridge existed. Accompanying their advance, there plodded many "tanks" of a new and improved type, stolidly indifferent to rifle and machine-gun fire. Four separate lines of trenches were carried that day, it was reported, and 9000 prisoners sent to the pens at the rear. By the end of the second day, the British had reached the outskirts of Monchy-le-Preux, full six miles east of Arras. About this village, vigorously defended by the Germans, the fighting centered for days; it was gradually wrested from the Germans, who were making desperate counter-attacks both in this vicinity and against Vimy Ridge.

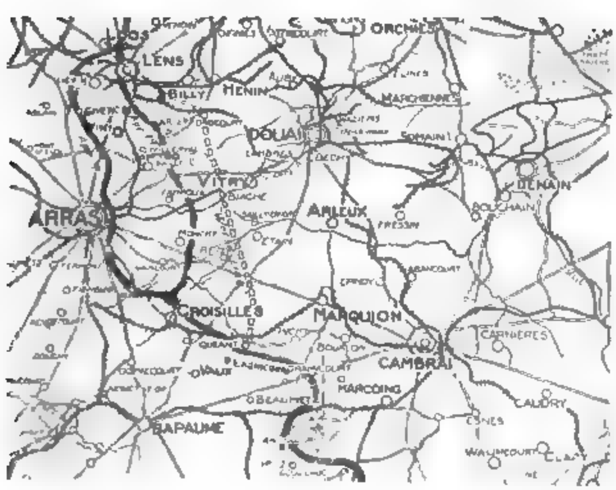
Meanwhile, while the Battle of Arras was being won by General Allenby's army, the forces under Gen. Horne, holding the line north toward La Bassée, became suddenly active in an enveloping movement about Lens. On the 14th they entered Lievin, only two miles southwest of the "Coal City," which the Germans had begun to evacuate. Farther south, the Canadians had pushed down the steep eastern slope of Vimy Ridge thru the town of the same name and a mile beyond. The captured artillery now numbered 200 pieces.

It was just a week later when the French initiated the *second* Battle of the Aisne. East of Soissons, near

the old Fort Condé, the Germans have, since 1914, maintained a bridge-head south of the Aisne. East from here, their line crosses the river and rests on the parallel ridge of hills to the north, then leaves the Craonne Plateau to recross the Aisne near Berry-au-Bac, and ties into the forts north of Rheims, which the Germans have made a formidable obstacle. Against the 25-mile front from Vailly to Berry-au-Bac, the French advanced on Apr 16, after an artillery preparation which had lasted (the Germans reported) ten days. This attack found the Germans better prepared than had the advance from Arras. The French secured no such depth of penetration; nowhere did they break the enemy's line. But their gains were considerable, averaging about two miles over the entire front. The Germans were driven from the bridge-head near Fort Condé; and Vailly, an important town just across the Aisne, was stormed from three directions (Apr 20). The advance north from here at this time, together with the eastward movement from Laffaux, created for the moment a pocket which seemed to threaten the capture of a large force of Germans. On Apr 21, however, with the capture of Sancy, this salient was eliminated and the line straightened once more, marking a maximum advance of four miles opposite the captured bridge-head. The position of the French on the north bank of the river was now much improved; the Germans had been driven back to the crest of the hills or beyond. Most significant of all, the French had taken at the end of the week's fighting full 20,000 prisoners, besides 100 guns. The Germans were left in possession of a strong line, extending along the ridge between Craonne and Fort Malmaison, and following the general line of the Chemin des Dames. Their counter-attacks, altho vigorously pressed, failed to shake the French hold on the newly-won positions. In one of these, the Germans claimed the capture of 3000 prisoners.

Another coincident attack east of Rheims was commenced by the French on the 17th. Here the line ran nearly due east along a series of hills, touching the old Champagne battlefield at Auberive. The French struck over a 10-mile front, advanced their line a mile or more to include a line of hills near Moronvilliers, captured Auberive, and took 2500 prisoners. The fighting in this section was continued more or less during the remainder of the month. Taken in conjunction with the attacks just west of Rheims, toward Fort Brimont, it was evident that the French, while avoiding the strong fort positions north of Rheims, were endeavoring to pinch them out by converging attacks on both sides.





Turning to the Cambrai-St. Quentin sector, which has been somewhat overshadowed in importance by the developments to the north and south, it will be noted from the map that the British advance beyond Beaumetz toward Cambrai had created a marked salient in the line. Against the left flank of this salient the Germans made vigorous attacks on Apr 14 and the following days. Their initial successes at Lagnicourt threatened to embarrass this whole part of the British battle-line, but by the 18th the English had made good their position, one body of Prussian Guards having been driven back on its own wire entanglements with heavy losses. In a month of such continuous and heavy fighting, only brief mention can be made of this action and many others, as the severe fighting in Havricourt Wood, and the gradual tightening of the net around St. Quentin.

On Apr 23, the fighting east of Arras, which had lost something of its first intensity, assumed a new phase. The British infantry advanced over the seven-mile front from Croisilles to Gavrelle, finding the Germans massed in their front, 10,000 to the mile. Such a concentration made progress extremely difficult. The British took Gavrelle and Guernappe, with 2000 prisoners, as that day's prize. Desperate German counter-attacks followed; and the fighting of these days was particularly sanguinary. Another forward surge of the British on Apr 28 won them Avleux, and a temporary hold on Oppy, which they were compelled to relinquish. This latter advance was less vigorously followed up; progress over this area, made more diffi-

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cult by the thousands of shell holes, is becoming much slower as the German defense stiffens.

The English at Oppy and Monchy are fairly astride the "Oppy line" that marked one German defensive front. But this line is generally recognized to be merely a "switch line" leading back to the so-called "Wotan line," which breaks off sharply from Lens to Drocourt, thence south to Queant. The official report claims for April the capture of 19,300 Germans, 257 guns and howitzers, 470 machine guns. It also states that the expenditure of ammunition during the second week of the Battle of Arras was six times as great as for the corresponding period of the Somme campaign, and was the greatest ever recorded.

May

The British advance in the Scarpe valley met with its first serious check on May 8 at Fresnoy, southeast of Lens. This village had been taken by the British on May 3, but was recaptured by Bavarian and Frankish troops five days later. Some 20,000 fresh troops were engaged in this assault, which was supported by gas shells. Altho a local success only, this result illustrates the stubbornness with which the Germans were now contesting every foot of advance. Fresnoy remains in their hands, and has barred further progress in this direction.

In the center of this great battlefield, Roeux for a time occupied a prominent place. This village is on the north bank of the Scarpe, due east of Arras; its chemical works, quarries and cemetery had been converted into a formidable fortress by means of underground passages, concrete covers and concealed guns. For weeks this was the scene of hot fighting, but finally the British completed its occupation on May 14, after severe house-to-house fighting. Perhaps the most stubborn fighting of the month took place further south around Bullecourt, where the line bends eastward from Croisilles. All thru the middle of the month the opposing forces surged back and forth in this vicinity. Capturing the town only to lose it again, the British made good their hold on May 17, but west of the village there remained some 2000 yards of German trenches which the English could not take, exposed as they were.

After May 20, no important actions were reported from the Arras front. Rather there was evidenced a markedly increased activity on the 30-mile front from Lens to Ypres. The frequent night raids in this sector indicate perhaps a tendency for the English offensive to work north, to ground the task of advancing over which is less formidable.

The *Army and Navy Journal* thus sums up the results of the campaign:

To deal with the Arras offensive, as a whole, up to the present point, it has given the British the possession of the German first and second intrenched system over the greater part of a front of some twenty miles, and it has cost the Germans the equivalent of more than two of their divisions in prisoners alone, not to surmise as to their losses in killed and wounded. It has drawn them to the displacement of troops brought from elsewhere to strengthen the endangered front. It has gradually slowed down, however, in the face of an increasingly formidable resistance and, judged by its record up to the present, it belongs with the Verdun offensive, the French Champagne offensive of September, 1915, and a number of other efforts of the present war, to the class of offensives which gradually led to immobility rather than to a decision."

A month ago, after two weeks of fighting, the French had won a position on the southern edge of the Craonne Plateau, following in a general way the Chemin des Dames. Briefly, during May they have been able to improve their position, and to reach at several points the northern edge of this plateau commanding the Ailette River valley. Their nearest point of approach to Laon is some eight miles distant, about the same as that which separates the British from Douai.

The fighting along this line has not been confined to any one locality, but attack and counter have raged all the way from Laffaux to Chevreux. For days at a time the French have remained entirely on the defensive, but on the whole their lines have crept forward slowly but appreciably. Their most important capture of the month was Craonne, a town of some importance at the eastern end of the ridge. This gain was made possible by a bold advance under plunging artillery fire. An incident of this attack, which throws light on the depth of the dug-outs, and the use of grenades in an assault, is thus reported:

"A French assaulting wave of infantry found a deep cavern at the foot of a steep cliff, west of Craonne, into which the grenadiers threw grenades while their comrades continued to advance up the slope. When they arrived at the top they observed a column of smoke pouring out of a hole on the summit of the plateau, and soon afterward a crowd of Germans numbering about 200 in all came out, having climbed 180 steps thru a chimney cut in the solid rock from the cavern below. The French had scaled the cliff quicker than the Germans had come up the stairs and they took all the Germans prisoners."

East of Craonne, the French line turns south to cross the Aisne River toward Rheims. All attempts to drive a wedge up this valley into the German lines have been thwarted by the resistance of Fort Brimont. The latter fort is a part of the strong defensive system of Rheims, on which the Germans have based their line north of the city. Avoiding any contest opposite the city, as we saw last month, the French made their other main effort farther east in the Champagne, directing their attack on converging lines, as if to pinch off the obstacle offered by the Rheims forts. The advance in the vicinity of Moronvillers was pressed vigorously once more in the last week in May, and as vigorously opposed by the Germans. A maximum gain of from two to three miles has been recorded in this sector.

Coming back to the Laon district, it is evident that the Germans, occupying a declivity with the Ailette at their backs, have all the worst of the position. A considerable French success now would not only secure that city, but would force a realignment of the entire Arras-Soissons front, the flank and rear of which would thus be seriously threatened. But nothing has developed

thus far to make such a success a near probability. The French, like the English, must seek as their objective to crush the man-power of the German army, using their own thinned forces as sparingly as possible in the process.

The other parts of the western front can be for our purposes at present neglected. St. Quentin, like Lens, still resists capture; tho the tightening lines have threatened at any time to cause their fall, the real strength of the Allies has been exerted elsewhere. As for the much-sought "Hindenburg Line," it seems increasingly evident that such a position, as originally conceived, is non-existent; that German reliance is placed not on a single rock-ribbed line, but rather on a flexible system of echeloned positions, a series of "switch lines" leading up to and supporting one another. The Allies' task of "breaking" such a line, of forcing a general retirement, is manifestly a stupendous one. Moreover, recent estimates of the German field forces do not indicate that the shortage of man-power is becoming acute. Such estimates have placed the strength of their field armies all the way from two and a half to four and a half million, of whom perhaps two-thirds are on the western front. German losses have been admittedly over four million, one-half of which may be regarded as permanent. But these have been offset to some extent by the utilization of impressed Belgian and French laborers, thus freeing fresh men for the front.

In this connection, the German point of view is well illustrated by a quotation from the *Frankfurter Zeitung:*

"Hindenburg is conducting the defensive war according to a new method. One can—at any rate in the fighting area of the French—call this a semi-rigid method. It seems, as far as can be judged hitherto and from a distance, to consist in a combination of the experiences of the war of position with the doctrines of the war of movement. Deep systems of trenches are most carefully constructed, and the defense in the trenches is mobile. The front trenches, which are exposed to the bombardment are most lightly manned; there is an elastic bending back; infantry attacks are received in skilfully constructed cross-positions; and powerful counter-strokes are made at the right time and in the right place. The successful result is that the loss of ground is slight, the casualties are diminished, and the attacks are defeated in an unusually brief infantry fight."

June

The end of May saw the British Arras offensive definitely stopped and a cessation of important actions along this front, the only activity being trench raids which were particularly frequent between Ypres and Armentières.

With the beginning of June the principal fighting was transferred to the western outskirts of Lens. On the night of June 2 the British launched a heavy attack on positions along the Souchez River. The chief objective was a heavily defended power house. This was gained, but was lost again the next day. On the 4th the power station was retaken and securely held, the operation being supported by attacks to the north, from the direction of Loos, and south of Lens, against the German position on Greenland hill near Gavrelle. In both of these sectors slight gains were recorded.

Early on the morning of June 7 the British struck the most energetic blow of the year against the salient between Ypres and Armentières, which included Hill 60 and the Messines ridge. After a heavy artillery preparation of ten days' duration, the assault was immediately preceded by the explosion of the most extensive mine system yet used in the war. It is said that the mining operations had been under way for over a year and that the charge consisted of 1,000,000 pounds of high explosive.

The action is thus described in the British official report:

"At 3:10 a. m. (June 7) nineteen deep mines were exploded simultaneously beneath the enemy's defenses, by which large portions of both his front and support trenches, including extensive dugout and mining systems, were completely wrecked. Immediately upon the explosion of the mines our guns opened and our infantry assault was launched.

"Within a few minutes the enemy's first line system was carried on the whole front attacked. Our troops then pressed on, with scarcely a pause, up the western slopes of the Messines-Wytschaete ridge, and three hours after the commencement of the attack had stormed the entire crest from south to north. Shortly afterward the whole of Messines was captured, and before midday the capture of Wytschaete village also had been completed after hard fighting.

"In the second stage of the attack our troops pushed down the eastern slopes of the ridge and advanced against a powerful line of German rear defenses. By nightfall practically the whole of this trench system was also in our hands and we had gained the whole of the day's objectives.

"Over 6400 prisoners, including 132 officers, have already passed thru the collecting stations as a result of yesterday's operations. More than twenty guns thus far have been collected."

By the close of the first day, the German counter pressure had become so heavy that further rapid advance was stopped. On subsequent days the British contented themselves with minor attacks for the purpose of straightening out their lines. The area gained was about nine miles long and some five miles deep at its widest point. The German salient between Ypres and Armentières has been completely wiped out, the new line running practically due north from Frelinghein, on the Lys, to the eastern end of the former British salient at Ypres. As the action closed the Germans were reported to have fallen back behind the Lys as far north as Warneton. The greatest advantage gained by this thrust is the control of the heights within the old salient. These hills present the only high ground in that section of Belgium, and their possession is a priceless advantage in that

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flat country. From their summits the country is visible to beyond Lille, Tourcoing and Roubaix, the heart of that industrial section.

On the night of the 8th, the British again resumed activities in the vicinity of Lens, attacking south of the Souchez River on a two mile front and penetrating to a maximum depth of a half a mile. Except for trench raids the front was then comparatively quiet until the 19th, when there was begun what proved to be a sustained movement on Lens. The first move was north of the Souchez and made a small gain. Then pressure south of the river began. The attack met with varying success but on the 24th Canadian troops succeeded in storming Hill 86, just west of the village of La Coulotte and the highest point in the immediate vicinity. By the 26th the Canadians had occupied La Coulotte and forced the Germans back to a line from Avion to Mericourt. The attack now swung northward. At the same time an advance was made from Lieven, a western suburb of Lens, southeast in the direction of Eleu on the Souchez. The success of this latter movement exposed the German right on the south of the river to reverse fire, forcing a retirement. The Canadian lines south of the river were quickly pushed forward to the outskirts of Avion and, as the month closes, they are slowly forcing their way thru the town itself. To the north of Avion they are directly between that village and Lens, and but half a mile from the heart of that city.

While this offensive was in full swing the British, on the 28th, delivered a sudden blow to the west and south of Oppy but with slight success. The Germans, also, attempted a diversion by an offensive on the Somme, but were repulsed.

With a few exceptions, the French troops kept on the defensive on the portion of the western front held by them. There was extremely heavy fighting, but with practically no result, at intervals thruout the month at various points from Verdun westward to Craonne and the Chemin des Dames. In the latter section the fighting was nearly continuous. In nearly all cases the attacking force was repulsed at once or was driven out by a counterattack shortly after penetrating the first line trenches. The net result of all the heavy fighting and its necessarily corresponding losses has been practically nil, tho it must be considered that the Germans received a definite setback as the severest actions were brought about by their attempts to retake ground recently won from them. The successes attained have nothing but purely local importance.

The Germans succeeded in gaining a foothold in the French trenches on the Chemin des Dames west of Craonne. Little harm will result unless these gains are greatly extended. In the last days of the month by a sudden attack on the west bank of the Meuse at Verdun they penetrated at a few points the French first line trenches on Hill 304.

The principal French success of the month—besides the general one of having repulsed the heavy German attacks—was in the Moronvilliers section of western Champagne. Here they succeeded in reducing a salient which projected into their lines between Mt. Cornillet and Mt. Blond.

At intervals thruout the month there was heavy cannonading and unusually active reconnoitering in the vicinity of Rheims, as tho one or both sides might be comtemplating offensive action in that region.

July

The end of June marked the close of the British movement against Lens, the German resistance having stiffened to such an extent that further efforts would have been unduly costly. The heavy masonry villages and farms of this section with their strongly walled cellars, the mine pits and numerous slag heaps, combine to make a terrain that is admirably adapted to the system of defense by inter-supporting nests of machine guns, which the Germans have developed to such a high state of perfection.

On the night of July 4 the British made an attack on the enemy's lines southwest of Hollebeke, by which they succeeded in advancing their front slightly on a length of about 600 yards. Hollebeke formed a strong supporting point for the northern end of the German line west of the Ypres-Comines canal. Altho it was left partly exposed on the southwest by the Wytschaete offensive of June 7, the Germans continued to hold it firmly until the heavy Allied blow of July 31. With the exception of this attack of the 4th, the British infantry remained practically inactive thruout the month until the very last day. There was the usual amount of trench raiding and the air service and artillery were unusually active, especially in Flanders.

The official reports of the first days of July, in referring to trench raids in the Nieuport region, gave the first intimation that the British had taken over the coastal end of the western front. The close of the first week in July marked the beginning of a heavy German bombardment of the positions east of the Yser. This was continued until the defenses and the bridges over the river had been demolished. On the night of the 10th the Germans launched an attack on this front. Unable to secure supplies and reinforcements, the defenders were quickly overpowered and the Germans drove forward as far as the Yser on a front of about a mile. A similar attack on the same night at Lombaertzyde, just south of the scene of this gain, was temporarily successful but the positions gained here were retaken by a British counter-attack. This German gain is relatively unimportant, the Yser river forming a second line of defense that can be held against much heavier odds than there is reason to think can be brought against it.

The general scheme of the Allied offensive this year seems to be quite different from that previously employed. The great blow of 1916, the battle of the Somme, was based upon the idea of continuous pounding on one comparatively restricted front. This method proved to be effective but expensive, even tho it cost the defenders quite as heavy losses. This year an entirely different idea seems to underlie the Allied

strategy. The fundamental conception appears to be that of a series of sharp but very heavy blows delivered at different points along the front, meanwhile maintaining pressure on the whole line by means of artillery. This is a difficult system to oppose if the attackers are willing to remain content with the gains secured in the first sharp struggle. The line cannot be reinforced until the infantry attack has disclosed the exact location of the threatened point. By the time the reinforcements arrive at this point in sufficient strength to counter effectively, the attack is over and the ground gained has been firmly organized.

The first indication of this changed system came at the close of the winter when the Germans fell back along the Somme front. They were evidently expecting that the Allies intended to resume their offensive at the point where it had been left off. Had this actually been the case, the German retreat must have materially deranged the Allied plans. In fact, however, the British attacked almost immediately east of Arras and the French in the Craonne sector. The strength of these attacks and the concentration of artillery and ammunition showed that these points had been selected long before for the opening of the Spring offensive.

This year's method is much less costly in men than the former one. The reduction of the Wytschaete salient affords an excellent example of this. In that battle the British casualties totaled not quite 10,000 men. Upward of 7000 unwounded German prisoners were captured and the total number of casualties among the defenders must certainly have been appreciably greater than those of the attackers.

At 3:50 o'clock in the morning of July 31 French and British forces opened an offensive in Flanders on a front of approximately twenty miles, extending from Dixmude to Warneton. The artillery preparation for the attack lasted some three weeks, at times reaching an intensity never before equalled. The German front line trenches were completely demolished over a great part of the front attacked. The French troops advanced on the line from Dixmude south to Steenstraete, from which point the British extended the attacking front as far as Warneton on the Lys. The advance was simultaneous over the entire front of attack. The Germans left few men in their forward trenches, depending upon breaking up the attackers' formations by machine gun fire, and making the main defense in the second line trenches. The British advanced rapidly and with little loss until they reached the German second line. Here they encountered serious opposition, but eventually succeeded in capturing most of this line and even secured footholds in the third line. In the course of their advance they took the villages of La Bassee Ville, Hollebeke, Verlorenhoek, Frezenberg, St. Julien, and Pilken.

The French incurred considerable losses in getting their attack started, as they had to cross the Yser in the face of the enemies' fire. In spite of the difficulties, they succeeded in constructing 29 bridges under fire and then swept forward nearly as far as had the British farther south. They occupied the villages of Steenstraete and Bixschoote. In the afternoon there began a heavy rainfall which quickly converted the turned-up earth into a quagmire, making movements difficult. In spite of this, the Germans counter-attacked heavily that night and succeeded in retaking St. Julien from the British and in driving them back slightly along the Ypres-Roulers railroad.

The Allied gains over the twenty-mile front attacked averaged somewhat over a mile in depth with a maximum penetration of about three miles. It is still too early to tell whether the offensive will be pushed at this point or whether it is still another of those short, heavy blows of which we have seen so much this year. The direction of the attack, approximately parallelling the Belgian coast, opens up interesting possibilities if it should be continued successfully. It is known that the Germans were not surprised by the operation and it is quite generally believed that their attack at the mouth of the Yser was made to prevent a British offensive along the coast in conjunction with that actually delivered. Any deep penetration of the German line north of the Lys would imperil their hold on the Belgian coast and would undoubtedly meet with determined resistance. It may be that the Allied leaders have come to the conclusion that the results to be anticipated from success in such an operation justify the losses which it must certainly entail.

The presence of French troops on this portion of the western front, which has been held by the British alone for such a long time, is an indication of something out of the ordinary. Speculation as to what it may mean is of little value when based upon no more information than we have at present, but it adds a keener anticipation to our scrutiny of the news of the next few weeks.

On the French front proper there has been little change from the course of events in the preceding month. The Germans have continued their costly attacks against the French positions, particularly in the Chemin des Dames sector, with some temporary successes, but most of the ground gained has been promptly lost again thru French counter-attacks. The month ends with little to show for the almost continuous fighting and heavy losses.

In the last days of June the Germans started an attack in the neighborhood of Verdun. The pressure continued for about two weeks, being confined almost entirely to the west bank of the Meuse, between that stream and Avocourt. The Germans at this point are at the same disadvantage that the British were at Ypres before the Wytschaete ridge was captured. The French offensive of last December secured the high ground on the east bank of the Meuse for some miles to the north of the lines on the western side. This exposed the Germans west of the river to fire from the flank and rear as well as from the front. The lines east of the Meuse were strongly held. The solution seemed to be to seize the heights on the western bank by a sudden attack, thus enfilading the French positions to the east and possibly forcing a retirement. This probably accounts for the resump-

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tion of activity on this front, which has seen the slaughter of so many thousands of the best troops Germany could muster.

The attackers succeeded in advancing their lines appreciably up the slopes of Le Mort Homme and Hill 304 and in Avocourt Wood. On the morning of July 17, by a sudden attack, the French won back all that they had lost and in some places advanced beyond their former positions. The Germans returned to the assault on July 27 and again on July 31, but with no material successes.

On the Chemin des Dames ridge there has been some of the heaviest fighting of the war. This name, "The Road of the Ladies," is becoming distinctly ironic. The highway, built by Louis XV for the pleasure of his daughters, has given its name to a ridge which will be known in history as the scene of some of the fiercest struggles of all time, where thousands of men have been killed in manners unthought-of when the road was named.

A very heavy attack was made on July 8 on the western end of the ridge. Here the Germans still hold a small part of the crest and the hill on which stood Fort Malmaison. Thus dominating the flank of the French position, they were able to gain the front trenches over a length of about two miles. The French recaptured about two-thirds of their lost defenses by means of a counter stroke the next night.

On the 9th the Germans attacked again at Hurtebise, some eight miles east of the scene of their advance of the previous day. Here they were without the advantage they enjoyed farther west and were repulsed with heavy losses. A night attack on the 14th gave the Germans about a mile of front line trench just west of Cerny; all but about 500 yards of this gain was immediately lost thru a counter-attack. Further attacks at this point on the 20th were all repulsed by the French.

Beginning with July 19, the heaviest fighting shifted to the eastern end of the ridge. This is the strongest part of the position and had been free from major attacks for several weeks. The assault, delivered by a select Prussian Guard division, was preceded by unusually violent artillery preparation and was directed against the Californie and Casemates plateaus, north and northwest of Craonne. The attack met with considerable success at first, but the French counter-attack regained everything but a small outwork on Casemates plateau and about 600 yards of front trench on the Californie. A second attack by the same troops on the 22nd was without result. On the 24th the French took the offensive, regaining all of the ground lost on the Californie plateau and advancing beyond their former front on the Casemates. A German attempt the next morning to retrieve their losses was repulsed heavily.

There was fierce fighting on the central part of the ridge, about Cerny and Hurtebise, during the last week of July, but with practically no resulting change in the conditions there.

The Champagne front was more active during July than for some time past, tho with only minor operations. The Germans made a small gain near Coucy on the 13th. The next evening the French attacked north of Mt. Haut, carrying the position on a front of half a mile to a depth of about 300 yards and capturing 360 prisoners. German attacks on the 19th and 22nd failed to gain. On July 26 a French advance north of Auberive occupied a section of the German front line which had been abandoned without a struggle. Berlin reports the recapture on July 25 of the ground near Mt. Haut lost to the Frnch on the 14th, but the French claim to have repulsed two attacks at this point on July 27, so the exact situation here is somewhat questionable at present.

August

The Allies' Flanders offensive which began on July 31 and which netted such extensive gains the first day, as noted in last month's review, was held up the next day by heavy rains which made the churned-up ground impassable, forcing both sides to refrain from attacking. On Aug 2 the British retook the position on the Ypres-Roulers railroad which they had lost in the counterattack on the first day. They also again drove the Germans from St. Julien and consolidated the village firmly. On the same day the French advanced portions of their new front slightly, especially at the point of juncture with the British, where the Allies attacked together.

No serious attempt at a further advance could be made, however, on account of the continued wet weather. The whole attention of the Allies had to be devoted to the problem of preparing the positions already won to resist the expected counterattacks. The ground was too soft for bringing up guns and supplies with any rapidity; the newly won trenches were flooded; and the difficulties in making repairs or constructing new shelters left the advanced troops in a particularly exposed situation. In spite of this, the Germans failed to press their counterattacks, doubtless because the weather conditions also affected their plans.

By Aug 5 the rain had stopped and the ground began to dry out. Early that morning the Germans attacked on both sides of the Ypres-Comines canal in the direction of Hollebeke. After some preliminary gains they fought their way into Hollebeke, but lost all they had regained before the British counter-attack. Other attempts made that night at Hollebeke and at Westhoek, farther north, were equally unsuccessful. The British advanced their lines on the 5th to the east bank of the Steenbeke river along a front of approximately a mile, beginning near St. Julien and running to the northwest. The French made some progress north of Bixschoote. Other minor gains were made during the next few days, but only one of any particular importance.

In the attack of July 31, the British advance was held up after their troops had occupied a part of Westhoek Ridge and most of the village of Westhoek. This ridge possesses considerable military importance as it dominates the surrounding country, giving its hold-

ers an appreciable advantage in that flat region. The British maintained their positions in the face of heavy artillery fire and several fierce counterattacks, but made no further advance until Aug 10. Early on the morning of the 10th they launched on attack on a front of nearly two miles south of the Ypres-Roulers railroad. The southern end of the attacking line, in the vicinity of the Ypres-Menin road, was stopped at once. The Germans were driven from their remaining positions in Westhoek village, however, and from the ridge, which was firmly secured by the British. Repeated desperate counterattacks against Westhoek Ridge failed to move the British, tho they were driven from the adjoining Glencorse Wood to which they had advanced from the ridge.

In the meantime the French, on the left of the British, had extended their gains northeast of Bixschoote and had forced their way on a narrow front across the Steenbeke. The French advance was largely the result of heavy artillery actions, no severe infantry engagements taking place.

On the morning of Aug 16, following an intense bombardment, the French and British once more started a combined attack on a front of about nine miles extending northward from the Ypres-Menin road. The troops on the southern flank were again held up by the strong positions near the road. On the remainder of the front an advance of about half a mile was made. The British captured Langemarck and pushed on several hundreds yards farther east. The French secured the flooded bottom of the Steenbeke to a depth of 1000 yards, capturing the village of Dreigrachten.

There were no extensive operations on this front during the remainder of the month; tho fierce fighting all along the new line kept up for several days after the stroke of the 16th. As soon as the German counter-attacks had been definitely stopped, the British instituted a series of minor assaults which improved their positions somewhat. Apart from a small gain along the Menin road, these attacks were almost entirely concentrated on the front between St. Julien and Langemarck. Northeast of St. Julien on the road to Poelcappelle, an advance on a front of 2000 yards secured several strong redouts and penetrated the third line of defense. Possibly the most important of these local gains was directly east of Langemarck, where Hill 35, a low knoll commanding the plain to the east, was captured. On the left of the British, the French were prevented from attacking by the flooding of the bottoms along the Steenbeke.

The Canadian troops before Lens succeeded in pressing their lines into the edge of the town during August. Their last previous attacks had been on the southern and southwestern fronts of the city. After a two weeks interval of relative quiet, they suddenly, on Aug 4, pushed forward some 200 yards on a front three-quarters of a mile long at the Cité du Moulin, west of Lens. Two days later their line for 600 yards to the south of the last gain was advanced an equal distance. Artillery fire on the south and west fronts was now increased in intensity, the bombardment gradually spreading to the north. On the 13th an attack from the west on a narrow front penetrated to within 800 yards of the center of Lens. By this time the artillery fire north of the city had developed into a heavy bombardment, and at dawn the next morning the real attack, to which these preparations had been leading up, was begun. The assault covered a front of two miles, extending from the northwestern outskirts of Lens to the Bois Hugo, northeast of Loos. After storming the first line defenses on the whole front attacked, the Canadians penetrated the German positions to a depth of about a mile, advancing as far as the western defenses of Cité St. Auguste, north of the eastern edge of Lens. The villages of Cité St. Laurent, Cité Ste. Emilie, and Cité Ste. Elizabeth were carried and the western half of Hugo Wood was secured. The most important position taken was Hill 70, east of Loos, which had marked the limit of the British advance in the battle of Loos two years ago. Five heavy counterattacks were delivered by the Germans during the course of the day, but without success. Fierce struggles ensued for several days, due to the unsuccessful German attempts to regain the lost ground, especially Hill 70 which dominates all the positions around the city. There were no further general engagements, tho the Canadians improved their positions by means of a number of local attacks, particularly on the west and southwest sectors. One such attack was unusual in that the assaulting troops, advancing in a dense fog, met a German counter-attack between the trenches. After a violent bayonet fight, the Germans were driven back and a position secured in the northwestern corner of Lens proper. The situation at Lens is now decidedly critical for the Germans. The city forms a pronounced salient extending into the British lines, which press it closely on all sides except the east. Hill 70 commands the entire area and from it artillery fire can be brought against all the approaches to the city, while the defenses to the south can be taken in reverse. Under somewhat similar conditions before the Germans have withdrawn voluntarily. The importance of the Lens district as a source for coal supply which must be kept from the Allies will, however, in all probablity make them decide for a stubborn defense in this case.

The British were comparatively quiet on the other parts of their front. Aside from the customary raiding, they made no offensive movements of more than local importance. Probably the most extensive of these minor attacks occurred east of Hargicourt on Aug 26, when an advance of half a mile was made along a mile front.

In addition to the heavy counterattacks at the points where their own lines had been pushed back, the Germans instituted a number of minor actions on other sections of the British line, with the evident intention of diverting the pressure from the threatened sectors. None of these attempts met with appreciable gains and apparently no great success was anticipated, the movements being purely in the nature of diversions. In one of these actions the Germans advanced against the front held by the Portuguese and were repulsed

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handsomely. Recent despatches state that there are now about 45,000 Portuguese troops on the western front.

For the first week after the beginning of the Allied Flanders offensive the German troops operating against the front held by the French remained quiet except for two small attacks west of the Meuse which met with no success. The sudden cessation of the heavy attacks in the Aisne sector was practically coincident with the Allied stroke farther north. This, coupled with the fact that the Germans around Ypres depended largely upon artillery and machine guns for their defense, the Allies encountering no heavy masses of infantry as usual, lends force to the belief that the German lines in Flanders may have been rather weakly held and that troops from the army of the Crown Prince had to be sent to the assistance of Prince Rupprecht.

Later in the month the Germans made a number of minor assaults with weak forces at Verdun, in the Champagne and along the Chemin des Dames. These operations were really large trench raids and gained no ground. In an attack on Aug 9 north of St. Quentin, German troops took a section of the French first line trenches but were ejected two days later. On the 11th and again on the 16th the French took the offensive on the Chemin des Dames and made slight gains toward Allies.

The event of the month on the French front was the sudden resumption of the offensive by the French troops north of Verdun. The blow was similar in many respects to those of last October and December. Like them, too, it was highly successful. After three days of artillery preparation, the attack was launched on the morning of Aug 20 over a front extending from Avocourt on the west side of the Meuse to Ornes on the east. The advance met with immediate success all along the line. On the first day the French captured Avocourt Wood, all of Le Mort Homme, and parts of Corbeaux and Cumières Woods west of the Meuse. To the east they took all of the great bend of the Meuse including Champneuville and the Côte de Talou, as well as Hills 344 and 240 together with portions of the Fosses and Chaumes Woods. The German counterattacks proved weak and ineffective, so the French continued their advance. Their most important single gain was Hill 304, the Germans being entirely driven from that eminence dominating the ground west of the river. By the end of the month the French had pushed their lines well to the north of the positions occupied at the beginning of the offensive, the advance being measured in miles rather than in yards as has become usual on the western front. The line now runs northeastward from Avocourt Wood to Forges Brook, south of Bethincourt, and thence to the Meuse across the Côte de l'Oie and north of Regnéville. East of the river the line extends from Samogneux, which is firmly in French hands, just south of Beaumont, and along the northern edges of Fosses and Chaumes Woods to the southern outskirts of Ornes. The advance has been so deep that the French artillery is no longer able effectively to support the attacking troops, necessitating the forward movement of the guns. Whether an attempt to continue the movement will be made when the guns have reached their new positions does not yet appear. Over 9000 prisoners, several batteries and quantities of material have been captured.

September

The comparative lull in the Allied operations in the Ypres sector, which marked the latter part of August, continued for the first three weeks of September. Heavy artillery fire was kept up by both sides almost continuously during this period, but no attempts to attack in force were made by either. The few small attacks made were without effect in altering the relative positions. In one of these minor actions, on Sept 12, the Germans drove their opponents from a small wood north of Langemarck. A second assault in the same section on the 16th was repulsed by artillery fire. The British, on their part made slight gains by attacks east and northeast of St. Julien, on the 14th and 18th, and east of Westhoek on the 15th. Trench raids by both sides, for purposes of reconnaissance, were of almost daily occurrence, the British being particularly active after the middle of the month. About this same time, the intensity of the British gun fire was increased as tho preparatory to an attack. On several occasions drum fire was taken up but no infantry assault followed. The Germans could thus form no clear idea of when or where the impending attack was to be delivered. Their front line troops and reserves were kept so long in constant expectation of immediate attack, that the actual advance, when it finally came, was in the nature of a surprise.

The immediate objective of the British operations east of Ypres is the so-called Passchendaele ridge, which runs southwest from the village of the same name and which is crossed by the Ypres-Menin road just west of Gheluvelt. The ridge is from seventy-five to one hundred and fifty feet higher than the surrounding country, and is practically the last of those elevations which formerly gave the Germans such an advantage in the operations in Flanders. The British have now captured all the other important heights and seem in a fair way to secure this one in the near future.

In former stages of the latest Ypres offensive, the British pressed forward to the western slopes of the ridge, seized a few of its spurs and outlying hills, and even gained a foot-hold on the ridge itself at the village of Westhoek, which is upon its western edge. All their attempts to gain the top of the ridge farther south in the vicinity of the Ypres-Menin road, however, were unsuccessful, and serious losses were undergone in the various attacks which were launched against this part of the line. Temporary gains were made at times, but the German counterattacks uniformly restored the former positions.

The defenses on this part of the ridge were particularly strong. Just south of the Ypres-Menin road lie the Shrewsbury woods, with Inverness Copse a short

distance to the north. On the road, at the crest of the ridge and midway between Hooge and Gheluvelt, is the village of Veldhoek. North of Inverness Copse, and separated from it and from each other by stretches of open fields, lie Nun's, Glencorse and Polygon woods, in order from southwest to northeast. These latter woods are just south and east of Westhoek. All the wooded tracts had been filled with nests of machine guns and with strong redoubts, all concealed from observation by the trees. Numerous farms scattered over the hills were fortified in a similar manner. Supporting the whole position was a strongly held ridge, somewhat higher than the main hill, extending to the northeast from Veldhoek.

It was against this formidable position that the main British effort was directed upon resumption of the offensive, the stronger attack advancing south of the Ypres-Roulers railroad, astride the road to Menin. A secondary attack was delivered between the railroad and Langemarck, to the north. The assault was started at daybreak on the morning of Sept 20. It was supported by what is described as the deepest and heaviest barrage yet seen. The defending infantry resisted desperately but the advance continued rapidly in spite of all attempts to hold it up. The gains averaged about a mile over the whole front between the Ypres-Roulers railroad and Hollebeke. All the wooded areas previously mentioned were taken with the exception of the eastern half of the Polygon wood. The village of Veldhoek and the eminence to its northeast were also captured. Toward evening the Germans counterattacked violently at this latter point, but failed to shake the hold of the British on their new positions.

The supplementary attack farther north was also successful, tho the gains were not so extensive as in the area of the main effort. The lines were advanced several hundred yards over most of the front attacked, especially northeast of Langemarck and southeast of Westhoek, where the village of Zevenkote was captured. At the close of the day gains had been made along the whole eight miles of the attacking front, most extensive, of course, in the section of the principal attack.

The Germans began their counterattacks almost immediately at different points along the line, tho they did not show great strength until late on the 21st, when a heavy blow in the vicinity of Graventafel, northeast of St. Julien, penetrated the British lines on a front of more than a mile. This success was of short duration, however, and the British soon restored their front. The main German efforts on the 22nd and the three succeeding days were directed against the sector between the Polygon wood and Veldhoek. They finally made a few slight gains but without materially affecting the general result of the British success.

On Sept 26, the British once more took up the offensive, this time on a front of about six miles, extending from St. Julien to a point south of the Menin road. The main blow was delivered in the region about Zonnebeke, where an advance of a mile was made, the village being taken and the lines pushed some distance farther to the east. Northwest of Zonnebeke, the gains averaged about half a mile in depth. South of the village the remaining portion of Polygon wood and a trench to its east were taken. Between the wood and the Ypres-Menin road, the Germans were forced to relinquish all that they had gained in their counterattacks of the preceding days, while south of the road they were pushed back for some distance down the eastern side of the ridge.

Beginning with Sept 27, the Germans launched a series of almost continuous and very costly counterattacks in an effort to retrieve the important ground they had lost. These attempts were continuing as the month closed, but no successes had been recorded. The British seem to be firmly established on the southern end of the Passchendaele ridge, and it would appear that, with the advantages which their gains thus far give them, the conquest of the portion still in German hands should present no insurmountable problem. It should certainly be a less difficult task than the one they have just accomplished. That the recent successes have not been without their cost, however, is shown by the casualty list for September, which reports a total of 104,598 men, as compared with 59,811 during August.

On no other part of the British line was there any attempt to undertake more than local operations. The Canadians at Lens, contented themselves with harrassing their opponents by means of artillery fire and trench raids, tho a few slight advances were made at points where their raiders found conditions favorable. As a result of a series of such small movements they have established themselves at one point within two hundred and fifty yards of Lens on the north. Some sporadic activity was manifested at the beginning of the month in the neighborhood of Villeret and Hargicourt, north of St. Quentin. On Sept 1 the Germans attacked and seized a section of the British front line trench there, but were soon ejected. During the next week the British in their turn made two or three small attacks, taking altogether some 1,000 yards of the enemy's first line, which they held against counterattacks. No further attempt to continue the movement was made, however, and the section soon relapsed into its former condition of comparative quiet.

A new device in trench warfare was mentioned in the despatches which cronicled a raid in the vicinity of Chérisy on Sept 16. It is stated that the British used a wave of chemically produced fog to conceal the raiders.

There was a great deal of raiding and numerous small attacks on the French front during September, but none of much general importance. On the night of Aug 31 and during the next day the French advanced north of Hurtebise and drove their adversaries from the Hurtebise plateau. This gain, while slight as regards the area secured, is of considerable local moment tactically. For several months the Germans have been able to cause the French a vast deal of annoyance thru their occupation of this small eminence, which has been used as a base for attacks against the main Chemin des Dames ridge. This source of danger

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has now been removed by the French success. The Gercan counterattacks upon the position lasted for three days but they were uniformly repulsed with material losses. On Sept 4 the Germans suddenly shifted their attacks to the Californie plateau but made no gains.

On Sept 8, the French attacked on a front of about a mile and a half on the right bank of the Meuse. They succeeded in entirely clearing the Bois le Chaume, while positions north of the Bois des Fosses were improved and the ridge dominating the Bois des Caurières was secured. The village of Ornes was entered and held for a short time, only to be lost thru a German counterattack on the 9th. With the exceptions mentioned, the French remained upon the defensive thruout the month.

For the greater part of the month the Germans, likewise, remained almost entirely inactive on the French front, except for raids. During the last week of September they suddenly developed a great access of energy and delivered a number of small attacks at many points in the Meuse sector, in the Champagne, and along the Chemin des Dames. Few of these efforts were made with strong forces. Practically all of them were repulsed by artillery fire alone. In the few cases where the artillery fire did not stop them and the French trenches were entered, counterattacks promptly restored things to their former condition.

October

The British offensive in the Ypres sector, true to the promise held forth by the gains of the latter part of September, scored very important successes during the month of October. By the close of September the British had secured the crest of Passchendaele Ridge as far north as Zonnebeke and had pushed the Germans back down the eastern slopes of the height at some points, particularly south of the Ypres-Menin road. The costly German counterattacks which were begun immediately after the British success of Sept 26, continued for several days but failed to regain any of the ground that had been lost.

While these attacks were still in full swing the British artillery again became very active in its bombardment of the enemy positions. No particular importance was attached to this as its object was generally believed to be the breaking up of the German formations for counterattack. It had been the established practice on the western front not to resume an important offensive movement until the enemy's counterattacks had been stopped, or had at least so slackened as to indicate that their main force had been spent. In this case, however, the British did not wait for a cessation of the German efforts but attacked while the reaction from the previous advance was still continuing with great intensity. In fact five German divisions which had been concentrated in the front line trenches east of Zonnebeke for the purpose of delivering an immediate blow were caught in the very act of attacking by the barrage which preceded the British offensive and were badly cut to pieces.

The advance was started at 6 o'clock on the morning of Oct 4 on a front of about eight miles, from the Ypres-Staden railroad north of Langemarck to a point south of the Ypres-Menin road. Ground was gained over the whole front. The German positions were penetrated to a depth of a mile and a half east and northeast of Zonnebeke, the villages of Broodseinde and Nieuwemolen being captured. Farther to the left the greater part of Gravenstafel ridge was over-run and the lines were pushed forward to the outskirts of Poelcapple. Between Broodseinde and the Menin road the gains were of variable depth, but the hold on the crest of the ridge was made secure thruout and in places the Germans were forced entirely back onto the flat ground to the east. About 4500 prisoners were captured.

Late in the afternoon and during the early hours of the night the Germans reformed parts of their shattered troops and counterattacked furiously but without success. Failing in these attempts, they abandoned their infantry attacks but deluged the new British positions with artillery fire. This continued almost without cessation for three days, during which time the British occupied themselves with consolidating their gains. On the evening of the 7th the Germans delivered a strong counterattack east of the Polygon wood. The assaulting waves were shattered by gun fire. The comparatively few men who reached the British trenches were taken prisoners.

During the night of Oct 6 there began a heavy rain accompanied by a very decided drop in temperature. This unfavorable weather continued uninterruptedly for a week, and at intervals thereafter thruout the rest of the month. The ground water in this flat portion of Flanders is only a foot below the surface under the best of conditions, except upon the tops of the few elevations. The effect of a continuous downpour can be readily imagined, especially when it is remembered that the soil had previously been thoroly turned up by the fierce and prolonged bombardments. The shell-torn earth was quickly converted into a veritable quagmire, while the innumerable shell craters scattered thickly over the fighting zone were soon filled to the lips with water and became so many miniature lakes with treacherous banks and bottoms of sticky mud. A less favorable terrain for active operations under such weather conditions can scarcely be imagined.

In spite of these difficulties the Germans were not long left undisturbed. Attacking at daybreak on the morning of Oct 9, the British, supported this time by the French on their left, once more resumed their advance. Handicapped as they were by the weather and the condition of the ground, extensive and important gains were made. The attack fell chiefly upon about six miles of front to the west of Broodseinde and was directed generally to the northeast. On the left the French had to force their way across the swampy bottom of the St. Jansbeek before they could really develop their assault. Overcoming the difficulties which were presented by this sea of mud, they soon drove the Germans from the village of

Mangelaere and pushed forward to the southern edge of the forest of Houthulst, where they entrenched a new line somewhat over a mile in advance of their former positions. Their gains covered a front of about a mile and a half.

The British were even more successful on their section of the front. Poelcappelle was taken, and tho the advance to the east of that village was soon stopped by the strong defense which was made in a stone brewery, the attacking troops pushed on for nearly two miles to the northwest. Still farther to the east the British moving out from Gravenstafel forced their way northeastward and gained the main ridge to within 1000 yards of the village of Passchendaele.

A secondary attack was delivered on the front of the former activity to prevent the defenders of that sector from assisting their comrades to the north. The gains here, while much less extensive than in the theater of the main blow, were nevertheless far from negligible. Between the Ypres-Roulers railroad and Broodseinde the Germans were forced well back down the eastern slope of the ridge. The British also improved their positions at Noordenhoek and Reutel, north of Gheluvelt.

The German counterattacks were unable materially to lessen the British gains, tho on the night of the 9th and during the 10th several of the more advanced sections of the new lines had to be withdrawn for short distances. This was true only in the low lands to the north, and it was claimed in the dispatches that the necessity for this action was due more to the condition of the ground than to the pressure of the enemy.

On Oct 12 the British once more moved forward on the front between Passchendaele and the Houthulst woods. The attacking troops advanced at 5:25 a. m. thru a sea of mud, knee deep in most places. Shortly after the movement began the rain commenced to fall in torrents. This made artillery support extremely difficult and so hampered the infantry that the advance was halted before the objectives were attained. In spite of this, gains were recorded at most points along the line, tho in some places the troops returned to their former trenches. The chief advantages were secured on the flanks of the attack. On the southern end the new lines were established within 500 yards of Passchendaele. From Poelcappelle to the Houthulst wood the advance averaged about 800 yards in depth, including the positions east of the village which had halted the previous movement. A strip of the Houthulst wood some 1300 yards long by 200 yards wide was also taken. The German counterattacks regained the brewery east of Poelcappelle, but were unsuccessful elsewhere.

There now ensued several days of comparative quiet except for intense artillery fire. The British occupied themselves with consolidating their new positions, while their adversaries seemed content to remain in their trenches, making preparations to resist any resumption of the attack. The reports from both London and Berlin commented regularly on the violence of the artillery exchanges and a continuance of the offensive was looked for daily. The anticipated attack came on the morning of Oct 22 on the front from Poelappelle to the western edge of the Houthulst wood. East of the former place several strong positions were taken including the brewery which had been the scene of so many fierce struggles. In the center, along the Ypres-Staden railroad, no permanent gains were made but more success was met with on the left of the attack. Here the British and French moved forward together into Houthulst wood, the former from the southeast and the latter from the south. Both forces made appreciable advances, the penetration being as much as 1000 yards in many places. Portions of these gains were later lost thru German counterattacks.

The heavy losses experienced by the assailants in these frontal attacks against the forest positions apparently discouraged further attempts at direct assault. The German defenses in Houthulst wood consist largely of great numbers of carefully concealed machine guns, whose location and destruction by artillery has proved to be extremely difficult. The Allies now seem to be attempting to work around the flanks of the forest and reduce it by severing its communications with the rest of the German line. The French have already taken a long step toward the accomplishment of such a purpose. Immediately west of the forest lies the so-called Merckem peninsula, a strip of land surrounded on all sides except the east by streams or canalized rivers. The bottoms along the streams are now deeply flooded. It was against this peninsula that the French directed their attention.

As a preparatory step they seized the village of Draeibank on Oct 26. The next morning they started the main attack, advancing thru water which in places was neck deep. The Germans seem to have depended largely upon the flooded condition of the ground at this point to protect them, as their positions were weakly held. The French attack was supported on the left by Belgian troops who crossed the Yser canal after the movement was well under way. The entire peninsula was occupied and the French entrenched themselves along the western edge of Houthulst forest. The territory secured was some three and a half miles long and from fifteen hundred to three thousand yards deep. Included in this area were the villages of Luyghem, Merckem, Kippe, Aschoope, Verbrandesmis and Kostermolen as well as a number of fortified farms. That the position was only lightly held is shown by the fact that only three hundred prisoners were taken.

The British transferred their attacks farther east during the last week of October. On the 26th a Canadian force, which had been moved up from the Lens sector, advanced against Passchendaele from the west, directing their first assault toward Bellvue ridge, a spur projecting from the main ridge west of the village. Their first gains were lost thru counterattacks, but they eventually established themselves on the spur and began working slowly for-

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ward. By the end of the month they had succeeded in entrenching a line close to the edge of Passchendaele on the west.

In the meantime a second British attack had secured possession of Polderhoek, north of Gheluvelt. The latter village was itself momentarily entered but the Germans restored their positions almost immediately.

Outside of the area of the Flanders operations the British front was exceedingly quiet. Even the usual trench raids appear to have been less numerous than is ordinarily the case. The principal British raids reported were north of Lens and near Monchy and Roeux in the Arras region. The Germans for their part showed no signs of aggressiveness, evidently preferring to conserve their energies to meet the main Allied offensives.

The French front too presented little of interest for the first three weeks of October. The French troops remained almost entirely passive, while the Germans made only a few minor attacks, principally in the Champagne and Aisne regions. These attempts were broken up with little trouble. In the midst of this seemingly innocuous situation the French suddenly executed one of the swiftest and most brilliant pieces of work that has been seen for some time. Tho really only local in extent, the suddenness and completeness of the success attained by the blow give it a decided interest.

The scene of the attack is about seven miles northeast of Soissons, where the battle line turned abruptly from north and south to east and west. In this corner, between the former line and the Ailette River and Oise Canal is a broken height rising from 200 to 300 feet above the surrounding country. The principal hill in the section is the one on which was Fort Malmaison, one of the former defenses of Laon on the southern side. Several villages were scattered over the area of some six miles long and half as wide. Numerous extensive quarries and underground galleries aided in the protection of the defending troops.

The French assault was preceded by a week of intense artillery preparation which gave ample warning of what was pending. The Germans, however, apparently believed that more time would be spent in the bombardment in view of the well known character of the defenses, and were taken by surprise when the time came. The infantry advance started at 5:15 a. m. on Oct 23. The defenders resisted stubbornly but were unable to resist the impetuosity of the French. Malmaison fort was quickly stormed, the defending division of Prussian grenadier guards being driven out with a loss of 1000 prisoners despite their determined resistance. Shortly thereafter the villages of Allemant and Vaudesson on the left were captured. The French troops then advanced from the fort and seized the village of Chavignon and the heights dominating Pargny-Filain to the east.

The Germans were now in a precarious situation with the river and canal at their backs and the French occupying the commanding positions in front. Their communications were too badly cut to pieces to permit of reserves being pushed up, and they withdrew as rapidly as possible to the northern bank of the river, tho not without severe losses. During the next two days the French completed the occupation of the territory south of the river and captured the village of Pargny-Filain. Over 12,000 prisoners and some 150 guns were taken in these operations.

In the first flush of their enthusiasm over the French success, many observers predicted the immediate evacuation of Laon by the Germans. This is a trifle premature, however, as the new French gains do not directly threaten Laon. The city is plainly visible from the recently won positions, but is still eight miles distant. The Germans are entrenched on the heights north of the Ailette. Any further French advance must again be made from the less advantageous position and with the added difficulty of the stream to cross at the beginning of the assault. The city cannot be said to be in real danger until the French have established themselves on the Laon plateau, either from the south or the west.

This statement should not be taken to indicate that the recent gain is without value. It has certainly inconvenienced, if not imperilled, all the troops defending the sector. From their new positions the French guns have a clear sweep up the valley of the Ailette, enfilading the southern slopes of the valley on which are the defenses which halted the advance over the Chemin des Dames. In fact the French artillery has already begun to bombard these German trenches, and the infantry, with the assistance of their favorably placed guns, has succeeded in gaining ground at two points on the Chemin des Dames ridge, at Cerny and at Froidmont. Indications are not lacking that the Germans will abandon the ground they now hold south of the Ailette and fall back to the higher ground north of that stream. Such a move would now be the part of wisdom as they can do no good by holding on, while they must necessarily be exposed to severe losses.

The western defenses of Laon in the forests of Coucy and St. Gobain may also be seriously embarrassed by the loss of the Malmaison heights. The French heavy artillery can now take these defenses in reverse in much the same fashion that it can those in the valley of the Ailette and may force a readustment of the entire German dispositions at the great bend in the line. In such an event the French may be enabled to secure a foothold on the Laon plateau from which an advance toward the city may be started with some prospect of success. It is thus seen that the recent gain, tho not of immediate vital concern, holds forth promise of very material advantages in the future.

November

November has been a red letter month for the British in the main theater of the war. During the

first part of the month they completed the conquest of all the important elements of Passchendaele ridge. Not content with this, they struck suddenly south of Arras on the 20th and penetrated deeply thru the "impenetrable barrier" of the Hindenburg line.

At the close of October the Canadians had pushed their lines close to the western edge of the village of Passchendaele. The Germans in and about the village were now in a serious predicament. The fire of the British from their newly won positions was so intense that the Germans were unable to reinforce their advanced troops or even to supply them at all adequately. The Canadians were thus free from danger of counterattack, tho very close to the enemy. They were consequently able to take their time in preparing for their next stroke. That they would be successful was almost a foregone conclusion under the circumstances.

The assault was made at dawn on Nov 6 over a front of about 2000 yards. All the objectives were taken before noon, less resistance being encountered than had been anticipated. Passchendaele was captured, together with the hamlets of Mosselmarkt and Goeberg, and the lines were pushed some 800 yards beyond the village. All the high ground that the Germans now retained was a small spur projecting to the northeast from the main ridge. This last dominating point was secured and the conquest of the ridge made complete by a new attack on Nov 10. The operations on that date also considerably widened the salient about Passchendaele and Goeberg, giving the British a firm grip on the northern end of the ridge. A coincident attempt to advance in the low-lying, marshy ground to the left was repulsed.

The British engaged in no more major attacks in this sector during the remainder of the month. Both sides kept up a heavy artillery fire, however. It was reported that the Germans had added to their artillery concentration until the intensity of their fire almost approached that of the British. Hoping to profit by their increased artillery power, they launched a number of violent counterattacks on the ridge positions but failed to make any gains.

While the Germans still hold a few points somewhat above the general elevation of this section of Flanders, all of these are considerably lower than Passchendaele ridge and are commanded by it. One of the most important of the positions in German hands is that of Houthulst Forest. Marlborough is quoted as saying, "He who holds Houthulst holds Flanders." But the German hold on these woods is seriously compromised by the latest British gains. The northern end of Passchendaele ridge forms a most admirable point from which to support a movement to cut Houthulst off from the rest of the defending line. Moreover the important railroad center of Roulers is now only six miles distant from the British positions and is plainly visible from the crest of the ridge. This town, which has heretofore served as the advance supply base for the German armies in Flanders, can easily be shelled from the newly won ground. The reverse which the Germans have experienced here is a serious one. Small wonder that von Hindenburg sent a force of his best troops to Passchendaele with orders to hold on at all costs.

Many observers believed that the period of diminished activity which followed the British capture of Passchendaele ridge was the natural result of the Italian situation and the dispatch to the southern theater of important forces. The Germans apparently believed the same thing. It was reported that the German high command were counting absolutely upon winter and the transfer of French and British forces to the support of the hard pressed Italians to render impossible any major offensive on the western front at this time. Nothing could have been farther from the truth.

On Nov 20 began what is referred to by many commenters as the most staggering blow dealt the Germans since the Marne. It came as a complete surprise. All the plans were laid and the necessary concentrations of men and material effected without the enemy apparently gaining an inkling of what was impending. The advance was made on a front of thirty-two miles from St. Quentin north to the Scarpe. The troops on the flanks did not attempt to do more than fully occupy the attention of the Germans in their immediate front. The real blow took effect on the ten mile front south of the Baupaume-Cambrai road. It was here that the most important gains were made, tho the holding attacks on the flanks scored advances along practically the whole line.

The assault started at 6:30 in the morning. There was no artillery preparation to warn the Germans of the impending attack. In place of using artillery to clear away the barbed wire entanglements, a great number of tanks were concentrated on the front of the main attack and moved forward in advance of the infantry to prepare the way. The tanks did not pause in their forward movement to complete the reduction of the enemy works, leaving that for the infantry who followed them. After passing the first line, the machines kept on, dominating the machine gun zone and passing beyond the second trench line.

Capturing Havrincourt at the outset, the left of the main attack successively gained the villages of Flesquières, Graincourt and Anneux. The right occupied Beaucamp, Ribécourt and finally the larger town of Marcoing, an important railroad junction five miles southwest of Cambrai. To the south of Marcoing the British gained possession of all the ground as far east as the St. Quentin-Cambrai canal. They even secured a small foothold across the canal near Masnières.

The attack was continued on the 21st. On this day the British took Noyelles, a mile east of Marcoing, as well as Cantaing, to the north. They also stormed two rows of trenches on the east bank of the canal. During the night they took Fontaine-Nôtre-Dame, a little village about two and three-quarters miles from Cambrai on the road to Baupaume. By this time the Germans had been reinforced and began a series of heavy counterattacks. The British were driven from Fontaine-Notre-Dame but held fast elsewhere. They

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spent the 22nd in consolidating their gains. Nov 23 saw the beginning of an attack on Bourlon wood and village, north of the highroad. The struggle raged back and forth for two days. On the 25th the British had secured the wood but had been driven out of all but the southern edge of the village, which they had occupied for a short time. Their attempts to advance at other points in the sector were repulsed. There was fierce fighting all along the new front during the remainder of the month but the relative positions were left unchanged on the whole. The British have succeeded in regaining a part of Fontaine village, portions of the ruins being held by each side.

The British gains in these operations were for a depth of about five miles on the sector of the main attack, covering a greater area than any other single attempt since the trench lines were established. The great success which attended their effort is to be attributed largely to the element of surprise. Credit for the enterprise is given General Byng, who was in charge of its preparation and commanded the troops who participated. Two traditions—the impregnability of the Hindenburg line, and the impossibility of a surprise attack on a large scale on the western front—were exploded. This is the first time assaults upon thoroly organized trench lines have been made until after the guns have blasted a way thru. Its success leads to the hope that a start has been made toward the discovery of a new tactical method of attack.

The first fruits of the capture of Malmaison heights by the French last month have already been reaped in the bloodless occupation of the German positions south of the Ailette. The looked-for retirement of the Germans from their trenches which were enfiladed from the new French positions took place on the night of Nov 1. Under cover of the darkness the Germans, moving with great secrecy, abandoned the entire northern slope of the Chemin des Dames ridge as far east as Corbeny, and fell back to the northern bank of the Ailette. Numerous mines and concealed pitfalls of various kinds were left distributed over the area to prevent a rapid pursuit. The bridges over the river were all destroyed as soon as the last of the retiring troops had crossed. The French advanced cautiously into the evacuated area, clearing up the traps as they went. By the afternoon of the 2nd they had completed the occupation of all the territory south of the river.

On other portions of the French front the raiders on both sides appear to have been unusually active. There were, however, no operations of major importance. The Germans made what seemed to be a serious attempt to drive forward on the right bank of the Meuse in the Verdun sector. After an intense bombardment their shock troops advanced against Chaume wood on the 3rd and again on the 6th. Both of these attacks were repulsed. The bombardment was renewed and a third assault was delivered on Nov 9. This time a number of French positions were captured, but the assailants were driven from most of them by means of counterattacks the next day. For the next two weeks this front was kept in a state of constant unrest by intermittent German bombardments and local attacks. On the 25th the French in their turn attacked and drove the Germans from the positions on Hill 344 which had been gradually secured as a result of the constant small gains. The enterprise was completely successful. The French pushed slightly farther forward than they had been at the end of their August offensive. The Germans were evidently taken by surprise and their counterattacks were ineffectual.

A local attack by the French east of Craonne on Nov 21 penetrated the opposing lines to a depth of 400 yards on a front of about 1000. A German attempt to gain ground at Mt. Cornillet in the Champagne was repulsed.

THE EASTERN THEATER

Reports from the entire region between Bukovina and the Baltic indicate little activity. The weather conditions along this front are those of severe winter. Most of the combats reported have been initiated by the Germans; several small actions of this sort have taken place in Volhynia. On the other hand, a Russian attack near Illukst was mentioned by the Germans on Dec 17.

The Carpathian front blends into the Rumanian theater farther south. Here the Russians made an effort to relieve the pressure on Rumania by thrusting thru the mountains at Von Falkenhayn's rear. The latter had invaded Rumania from the north and not from the west; one of his important railroad lines of supply thru Kronstadt, ran close to the Moldavian frontier. By breaking thru the mountain passes, the Russians might conceivably capture this line and threaten the invaders' rear, especially since the Austro-German troops were supposed to have been largely withdrawn from this line. The chief effort was made in the Trotus Valley, which leads up into the Gyimes Pass. A handful of villages was taken, and on Dec 7 the Germans admitted a slight retirement, but Falkenhayn's armies were never in the slightest danger from these attacks. Indeed, the mountainous nature of the country made the dash for the Russians a well-nigh hopeless one. At various other points along this line at Dorna Watra and Kirlibaba, the Russians maintained for days a continued pressure. Finally, after the middle of December, the offense suddenly slackened, without having gained any considerable advantage.

"The Russian aggressive in the whole southern Carpathian region was restricted by disconnected assaults upon scattered defensive positions, in which success gained at one point had slight influence on any other."

January

Just why the Russians should have chosen this time for an offensive on their northernmost front is a question that puzzled the observers. It could have no effect in relieving the pressure on the retreating Russians 500 miles to the south. Altho hailed by friends of the Allies as promising in its possibilities, it subsided after a week, as so many other offensives have done.

It is now seen to have been merely a local thrust against Mitau, which has been in the Germans' possession since the summer of 1915. Taking advantage of the frozen marshes, the Russians moved along the southern edge of Lake Babit until they reached the Aa River. Here some spirited fighting occurred during the period Jan 5-11, the Russians gaining a total distance of three miles, and taking a thousand prisoners and 32 guns. Their greatest gain for one day was one and one-third miles. In subsequent fighting the Germans claim to have regained much of the ground lost.

February

The Russian offensive undertaken by General Dmitrieff against Mitau ended Jan 11, after meeting with moderate success, and left the Russians in possession of both banks of the Aa River, near Kalizem, about 15 miles north of Mitau. After two weeks of comparative quiet, which gave the Germans time to organize a counter-offensive, heavy fighting recommenced, on Jan 23, and lasted until Feb 3. During this time the Germans were generally on the offensive, and claim to have won back most of the ground previously yielded. The attacks on Jan 25 and Jan 30, they reported, resulted in an advance of nearly a mile northward along the Aa toward Schlock, and the capture of 1400 prisoners. This latter attack was preceded by a bombardment of four hours, during which shells charged with chemicals were freely employed. For their part, the Russians contested these movements vigorously, and assert that they have maintained their hold upon the river road and upon both banks of the stream. In one action, armored motor cars, practicable over the solidly frozen ground, were employed to excellent advantage by the Russians, and were able to deliver an unexpected fire from their light guns.

Elsewhere on the Russian front operations were of minor importance. Raids occurred at various points on the long battle-line, the Germans being in most cases the the aggressors. Stanislau was subjected to a heavy bombardment on Feb 9. In several actions, the German troops wore white garments for protective coloration.

March

During the last month, as well as the months immediately preceding, the Central Powers have had all the best of the minor contests along the eastern front. They have taken the initiative much more frequently, and shown a keener aggressiveness than the Russians. Since the Czar's abdication, the inactivity of the Russions has been, if anything, more marked than ever, altho the attitude of the army toward the new government is one of acceptance, if not of actual friendship. The political developments help to explain the military situation as it has existed for months, and which the other Entente Allies regarded as rather hopeless.

Among the numerous minor affairs of the month initiated by the Teutons, mention should be made of an assault along the Jacobeni-Kimpolung highroad (Feb 27), a vigorous thrust toward Ocna on the Trotus River in the Carpathians (Mar 8), and some subsequent attacks on the Narayuvka River in Galicia, on the Stokhod, and near Dvinsk. The attack from Jacobeni yielded 1300 prisoners, the largest capture of the month. The Russians, for their part, showed some activity in the vicinity of the Jablonitza Pass, on the lower Danube, opposite Galatz, and in the Baltic region near Mitau.

The new government at Petrograd, in addition to its political burdens, is apprehensive of an impending Teuton offensive directed against the capital. A manifesto has been issued to the troops, warning them to expect such a move; and it has been proposed to remove the seat of government to Moscow. The able General Russki is in command of this threatened front; and the setting in of the spring thaws should have the effect of making such a move impracticable for at least a month.

April

The most effective stroke against the Russians this year was made on the Stokhod River, on Apr 3. Since the offensive against Kovel in 1916, the Russians have held the western bank of this stream, with little opposition. The German attack was launched against the Toboly bridge-head, found the Russians unprepared (two generals were relieved as a consequence of the affair), and drove them across the river, capturing 15 guns and nearly 10,000 men. This attack was almost the last manifestation of the aggressiveness the Germans have displayed previous to this month. Their recent inactivity has given point to the persistent rumors that a separate peace between Russia and Germany is not an improbable development.

The situation among Russian high commanders was somewhat cleared up with the appointment of General Alexieff to the supreme military command. General Kuropatkin has been arrested by the revolutionists.

On Apr 23 came an unofficial report of the sailing of German transports from Libau. "This port," comments the *Army and Navy Journal*, "is the nearest place of shipment for any troops that might be sent from Germany to make a descent upon the Russian coast, between Riga and Petrograd. The ports of Pernau, Reval and Narva lie along this stretch of coast, and one or another would offer a base for an expedition to cut Dimitrieff's Riga force off from the capital. The possibility of such a move is in line with the fact that Germany in 1915 made two attempts to descend on Riga by sea from the rear."

May

It has been a lean month in Russia, in a military sense. Early in May the demoralization of the army became acute, as a result of the Socialist peace agitation, and the undermining of discipline due to the soldiers' councils which had been generally established. Soldiers fraternized openly with the Germans. Many officers resigned their commissions, in despair of maintaining discipline under such conditions. The weakness of the military forces was so apparent that the Germans could with perfect security despatch many of their units from this front to France.

As May wore on, an improvement in these conditions was evident, as a result of the heroic efforts made in this direction. A new coalition cabinet was formed,

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which displayed elements of strength, particularly in its War Minister, Kerensky. Generals who had resigned, like Brusiloff and Gurko, were persuaded to retain their posts. The sporadic Russian attacks, at scattered points, which had been too insignificant to merit attention, became more consistent and frequent, as if the Russians were endeavoring to hold the Germans facing them on this line. Still, no offensive developed of a nature to keep the Germans fairly occupied.

At any rate, the German offensive of which the Russians appeared so apprehensive, has not developed. Whether the Russians can thank the French and English for calling off the German troops intended for this purpose, or whether Germany deems the advantages of a prospective peace greater than those promised by a successful offensive, is a matter for conjecture.

The Rumanian army is now reported as reorganized and ready for service on the Rumanian front under Gen. Averescu.

June

The Russian front has been characterized thruout the month by a continued absence of all operations of a general nature. Sporadic artillery actions and occasional trench raids at widely separated points have been the only signs of military activity. These small enterprises appear to be conducted by bodies of troops desirous of giving the army an example of military energy and of inducing a general resumption of hostilities. These attempts have been most common in the southern part of the Russian line, about Kovel and in the Carpathians; that is, in the portion held by the troops who participated in the big offensive of last year.

On June 5 was announced the resignation of General Alexieff from chief command of the Russian armies, which position he had held since April 15 without coming to any working agreement with the civil authorities. He was succeeded by General Brusiloff, who, it will be remembered, was in command of last year's offensive operations in the southwest. General Brusiloff recently resigned his position as commander of the southwestern front, but was prevailed upon to withdraw his resignation. He is one of the ablest of Russia's military leaders and a firm believer in aggressive action whenever and wherever possible. The Russian Army under his command should give a good account of itself if the present apathy is once overcome. The army by itself, however, even should it abandon its present attitude of apparent disinclination to undertake active operations, can accomplish little unless the government behind it is able to give it ample support, which is still doubtful.

Tho the military situation on the eastern front presents little of interest, such is not the case as regards political evens in Russia. The political and military situations are so closely inter-related that a discussion of the latter without some consideration of the former would be incomplete.

Closely following last month's agreement between the Provisional Government and the Council of Soldiers' and Workmen's Delegates came a Petrograd dispatch, dated June 1, stating that a local council of the workmen's organization had seized the fortress of Kronstadt and denied the authority of the Provisional Government. A week later it was announced that the "Kronstadt republic" had surrendered unconditionally. That the situation is not, however, entirely cleared up, is shown by the fact that the general congress of peasant delegates assembled in Petrograd on June 12 adopted resolutions condemning the Kronstadt authorities and proposing to shut off their provisions.

Local assemblages in practically all parts of the country have acknowledged the authority of the Provisional Government, and it is apparently actively opposed by only a very small radical minority. It seems to be without power, however, adequately to enforce discipline on the people and the internal disorganization of the country has improved little if any.

A further source of embarrassment is the assembling at Kiev of a congress to consider the question of establishing an autonomous government for the southwestern portion of Russia, known as the Ukraine.

In spite of all internal difficulties, there is still reason not to despair but that at least a semblance of order may be brought out of the present chaos. The Russian people, as a whole, honestly desire to win this war in concert with their Allies, and there is hope that necessary, if painful, measures, will not be long delayed. The government is not without able leaders. Prince Lvoff, the Premier, gave ample demonstration of his abilities in his handling of the *zemstvos* before the revolution. The Minister of War, Kerensky, probably the strongest man in the coalition government, has been indefatigable in his efforts to restore offensive action by the army, properly supported by the civil population. He has great influence with the Russian people, and is intensely popular with the army. The close of the month finds him along the front exerting his recognized eloquence in impassioned pleas to the soldiers to move against the enemy. It appears not improbable that his efforts may be successful.

In Moldavia there have been a few minor clashes evincing an increasing energy on the part of the Rumanian army, which has been reorganized and reequipped and is now anxious to take the offensive, if it can be assured of adequate support. Before the war the Rumanian army was considered better trained and more efficient than that of any other of the smaller European states. It was, however, overwhelmed by the German drive against it, aided by treason from within and by lack of the promised Russian assistance, and was driven from two-thirds of its country with a loss of almost a third of its members. Altho apparently so thoroly beaten, it cannot be said that the army was given a fair chance and it may yet redeem itself if sufficient support can be given by Russia.

July

The Russian front, after its long period of inactivity, has once more come into prominence. On July 1 the Russians began an offensive which furnished one of the most remarkable surprises of the war. That their army, after its inactivity for so many months under such demoralizing circumstances should have been able to shake off its lethargy and strike as it did is truly amazing. Everything indicated that the Russian army would be in no condition for months to come to undertake important operations. In the first place, the internal condition of the country was not such as to favor the idea of military activity. The manufacture of munitions was almost stopped by strikes and industrial disturbances; transportation was demoralized to such an extent that the distribution of foodstuffs to the civilian population and of supplies to the army seemed to be practically at an end; workers in general thruout the country had apparently given themselves up to an orgy of enjoyment of their newly gained freedom; German spies and agents were busy in their attempts to prevent any return to normal conditions; the government seemed totally unable to enforce its decrees. The army itself was honey-combed with disorganization, lack of discipline and treason; the men had, until very recently, been fraternizing with the enemy between the lines.

In spite of all this, the blow, when it came, proved surprisingly heavy. As usual, the Russians started their offensive against the part of the front held by the Austrians. All of the important attacks were delivered between the Brody-Lemberg railroad and the Carpathians. At the beginning of July the Russian line in this section was just where it had been left at the end of Brusiloff's offensive last year. As far south as the railroad running eastward from Rohatyn, the line followed the eastern bank of the Zlota Lipa river. At that point it crossed to the western bank, which it followed for some ten or twelve miles, then curved westward to the environs of Halicz, which it closely encircled on the east and south. Thence the line approximately followed the course of the Zlota Bistritza southwestward past the town of Zolotvina to the Carpathians.

The principal attack on July 1 was delivered north of Brzezany, where a considerable section of the front was stormed, and three lines of trenches including the village of Koniuchy were captured. Continuing with unabated energy the next day, the attacking troops greatly increased their gains in this section. Attacks to the east of Brzezany and farther north toward Zloczow were, however, repulsed. By the third day the fury of the attack had somewhat spent itself and counter-attacks began to make themselves felt. There was violent fighting in this sector for several days, but the principal further success of the Russians was the capture, on July 6, of Sviniuchy, around which such furious struggles centered in the last offensive.

The main attack now shifted to the south side of the Dniester. Beginning on the 6th, advance detachments started feeling out the enemy. On the 8th General Korniloff's troops attacked on the front from the river to Zolotvina. They met with immediate success all along the line, piercing the enemy's position at many important points. That the Austrians were thoroly defeated is shown by the reports that the pursuit was taken up by cavalry, a certain indication that the opposing forces are badly broken. The next day the westward movement continued, meeting with little resistance. A portion of the right wing swung northward towards Halicz, which was occupied on the 10th, detachments being immediately thrown across to the northern bank of the Dniester. On the same day the main advance reached the Lomnica, which was crossed by the troops near its mouth. On the 11th Kalusz on the western side of the river was taken and held after severe fighting. German and Austrian reinforcements now arrived in sufficient force to stop the advance. The Russians, finding themselves unable to enlarge their salient on the west bank of the river after several days endeavor, finally withdrew to the eastern side on the 16th. In the meantime their left flank had moved up along the foothills of the Carpathians to the upper Lomnica, and a new line was firmly established along that river from the Dniester to the mountains. The Russians captured during these operations some 39,000 prisoners and 135 guns.

Immediately following this brilliant offensive, the result of the months of disorganization in the Russian army suddenly manifested itself in a complete reversal of form. On July 19, with the aid of heavy German reinforcements, an attack was begun against the Russian positions in the vicinity of Zloczow on a front of about twenty miles. Early in the action one Russian regiment abandoned its trenches and marched to the rear. Other units quickly followed its example. Of the regiments ordered up to reinforce the line, many held meetings and decided not to obey their orders. Soon larger units, even divisions, were falling back with no attempt to oppose the enemy. A number of loyal regiments, assisted by British armored motor cars, attempted to avert disaster, but their efforts were of only temporary effect. Soon the exultant attackers were pouring thru the gap in the Russian line. On the 21st, after having advanced well to the eastward, the right flank of the attack swung south toward the Dniester, threatening the rear of the Russians south of that river. Podhajce and Jezernay were quickly captured with large stores of supplies. At Buczacz the attack was held up by a determined resistance until the 24th, giving the Russians south of the Dniester time to retreat from their dangerous situation, which they promptly did, abandoning Stanislau and all the territory to the west of that city.

The left wing of the German forces captured Tarnopol on July 23, and on the same day they forced a crossing of the Sereth river farther north at Mikulice. Tarnopol, with its enormous stores of supplies, was taken with practically no opposition. Continuing their advance, the Germans, by the end of the month, had forced the Russians entirely back of the Zbrocz river, which forms the boundary between Galicia and Russia north of the Dniester. A crossing of this river was forced at Husiatyn and Russian territory was entered at a point some seventy miles east of Halicz, which the Russians had taken less than three weeks previously.

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South of the Dniester the Russian have lost all of Galicia and a large part of Bukowina. At the close of the month it seemed but a question of days until the remainder of Bukowina, together with its capital, Czernowitz, would have to be abandoned.

This serious reverse has been caused by the unwillingness of many Russian troops to obey orders and fight, and not by any sudden loss of fighting power of the army as a whole, except as that power is affected by the general disorganization. Many units resisted the enemy's advance with determined heroism but had to fall back as a result of the disaffection of the others. The Revolutionary Government has taken severe steps to stamp out the spirit of mutiny in the army, with what results remains yet to be seen. The resistance appears to have stiffened to some extent, but nothing indicates that the operation is nearing an end. At the close of the month General Brusiloff resigned as Commander-in-Chief of the Russian armies and was succeeded by General Korniloff, whose place as commander of the armies on the southwestern front was taken by General Tcheremissoff.

During the latter part of the month Russian troops at various points in the northern part of the line attacked in an effort to divert German forces from Galicia, but met with little success. Beginning on July 24, the Rumanian army under General Averescu instituted an attack as a diversion to the Galician operations, which has so far met with considerable success. The area attacked is toward the northern part of the Rumanian positions. At the end of July 5000 prisoners and over 100 guns had been captured. The Austrians were reported in retreat and the advance continuing.

August

During the early days of August the Germans and Austrians completed the reconquest of eastern Galicia and Bukowina, continuing the movement which they were carrying out at the close of July. The Russians were driven back behind the boundaries of these provinces all along the line of the advance. A small section of Galicia in the vicinity of Brody, possibly thirty miles long with a maximum width of about five miles, appears to be still in Russian hands. This area, which lies to the north of the line of the German attack, is the only enemy territory that they now hold.

As soon as the Austrian boundary was reached the pursuit of the broken Russian army was discontinued, and the troops of the Central Powers took up positions to protect their gains. At a few points small bodies of Russians made local attacks upon these new lines without appreciable results, but there was no more general activity on this section of the front, which remained essentially quiet from the middle to the end of the month.

At the end of July the Germans had forced several crossings of the Zbrocz river and were holding bridgeheads in Russian territory. Within a few days they fell back at all of these points and took up their positions on the right bank of the Zbrocz. It is believed that this step was political rather than military in its conception. Berlin has not yet given up its hopes of making a separate peace with the new Russian government, and it was probably feared that any advance into a new section of Russia would so inflame the national ardor as to effectually blast all remaining chances of such a peace. An advance eastward would serve no particular purpose in any event, unless it were carried sufficiently far to secure the port of Odessa and the grain producing region to the north. As one of the Russian generals stated during the last great German offensive, the Russians still have all of Asia across which they can retire, so the Germans would merely be lengthening their lines of communication to no end, if they cannot break down the fighting power of their opponents.

In the latter part of the month the Germans suddenly began active operations on the Riga front, which has been quiet since General Russky's offensive last winter. On the 20th an attack west of the Tirul marshes in the vicinity of Tukkum forced the Russian advanced posts to fall back close to the river Aa. The next morning an artillery bombardment between the Aa and the Tirul marshes farther to the south caused the evacuation of much of the territory taken by General Russky. Most of the Russian troops did not await the infantry attack, but abandoned their positions as soon as the artillery fire became sufficiently strong to indicate a serious attempt to advance. This line of approach toward Riga is not very favorable at this time of year on account of the extensive belt of marshes south and west of the city. The Germans therefore did not advance far in this section, but transferred their operations eastward to the line of the Dvina river. Heavy artillery fire along the Dvina was reported for several days at the end of the month. Indications appear to point toward a determined effort by the Germans to take Riga, probably by forcing a crossing of the river east of the city and advancing from that direction.

It appears to be the general belief that the capture of Riga and the piercing of the Dvina front would be a direct threat against Petrograd and would probably be followed by an advance against the Russian capital. The two cities are over three hundred miles apart, but the intervening country offers few advantages for defensive action against an aggressive enemy. From the recent performances of the Russian troops, it is doubtful if any determined resistance could be opposed to such a movement in any event. The capture of an enemy's capital, tho often of little strictly military importance, is usually construed as conferring a considerable moral advantage upon the conquerors thru the disheartening effect on the people of seeing their center of government in the hands of their foes. It may be that the German higher command believes the time ripe for such an enterprise, tho this is in direct conflict with their apparent action in retiring from Russian territory on the Zbrocz. In this particular case, moreover, it is doubtful if the fall of Petrograd would affect the Russian people greatly. Tho Petrograd has been the seat of the Russian gov-

ernment thruout the modern history of the nation, it is Moscow, the ancient capital, which holds the affection and sentiment of the country, and it is probable that the government would be strengthened rather than weakened if it were forced to move to the older city.

Artillery actions were reported at intervals thruout the month at many different points between the Dvina and the Pripet, particularly in the sectors about Dvinsk, Smorgon and Baranovichy. These reports were more frequent toward the end of August. Tho some of the exchanges reached an intensity which seemed to portend an attack, there were no infantry actions of moment.

September

On most of the Russian front there has been no activity of any consequence during September. The object of the Teutonic drive thru Galicia and Bukowina was apparently attained when the Russians were driven from those provinces, and there has been no resumption of the offensive in that region. Frequent but more or less desultory artillery exchanges and some minor infantry actions occurred at various points along the front from Bukowina as far north as Dvinsk, but there has been a total lack of important operations on this section of the line.

Along the Dvina, however, and particularly on its lower reaches, in the Riga sector, events have transpired which have materially altered the situation which has existed practically unchanged for two years. The offensive which the Germans started against Riga in the latter part of August continued during the opening days of September, meeting with overwhelming success.

On Sept 1, a heavy bombardment was opened upon the Russian lines north of the Dvina, on both sides of Uxkul, some twenty miles southeast of Riga. Later on the same day the Germans crossed the river and established themselves on the northern bank, encountering little opposition. The Russians hastily abandoned Riga without attempting to make any defense. The line of the Dvina being now turned, the positions along that stream as far as Friedrichstadt were given up. The garrison of Riga retreated northward along the coast and northeastward in the direction of Pskoff. The former defenders of the river positions fell back to the northeast in the main, pivoting on Friedrichstadt, and apparently keeping in reasonably good touch with the retiring troops farther north. The Russian losses in men during these operations were very small in comparison with what might be expected in a retreat on such a large scale. Many guns and large quantities of supplies, which can be illy spared, were, however, abandoned to the enemy. The Germans, following close upon the heels of the retiring troops, quickly overcame such resistance as was offered, and captured a number of small bodies which had become isolated from the main Russian army. A total of some 10,000 men was captured in this way.

To the north the Russians fell back behind the Livonian Aa and have apparently maintained themselves approximately on that line. Northeastward, the retreat continued longer, no formidable resistance to the pursuit being presented until the Russians reached a line thru Segevold, some thirty-five miles from Riga. Here the advancing Germans were stopped, and were even forced to retire at some points. In the meantime a further length of the Dvina line had been abandoned, the western end of the Russian positions along the river being now at Kokenhusen, about twelve miles east of Friedrichstadt. By the 10th of September a new line had been established extending northwestward from Kokenhusen thru the village of Lemburg, to Segevold on the Livonian Aa. A rapid advance and sudden attack on September 21 resulted in the capture by the Germans of the city of Jacobstadt. The loss of this city forced the Russians to rectify the southern end of their new line. Except for this and for a few minor readjustments brought about by local attacks of the Russians farther north, there were no changes in the positions during the last two-thirds of the month.

While the German offensive now seems definitely halted, there is no apparent reason, with the recent happenings in view, why the new Russian line cannot be forced whenever the Germans see fit. It is many times weaker than the position just lost by the Russians, and the cessation of the German movement must be attributed largely to their own decision to stop. They have secured Riga, which they have long coveted on account of its importance as a port and commercial center. The near approach of the fall rains would render very difficult any extensive operations in this swampy region, and it seems doubtful if the much discussed drive against Petrograd is to be looked for as an immediate sequel of the recent operations. With unfavorable weather so near, rapid and continuous movement would be a prime requisite in such a campaign. The comparative quiet for the past three weeks appears to preclude the possibility that the German high command is contemplating any such ambitious plan as was accredited to them by many observers.

The fall of Riga furnishes an illuminating commentary, were one needed, on the present demoralization of the Russian armies. This locality affords exceptional facilities for a successful defense. It was here that the grand German offensive two years ago was halted, in spite of the furious attempts to capture Riga and the enormous losses suffered in that endeavor. It must be remembered, too, that the defense at that time was made by troops who had just been driven back for some two hundred miles, who were short of arms, ammunition and supplies, and who had every reason not to be in condition to make a sturdy resistance. The result was such as to make it evident that a comparatively weak force, if animated by the true fighting spirit, should be able to hold the position against practically any odds. How pitiably different were the

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results of the recent events. The strong positions, many of them manned by the same troops who had defended them so heroically and successfully on the former occasion, were weakly abandoned with scarcely a struggle. In the face of such conduct, it is not too much to believe that the extent of the German operations on the eastern front is only to be limited by their own wishes, unless the western Allies can keep them so busy that they must strip the Russian lines bare.

During the midst of the operations against Riga, there occurred an event, partly political in its nature, which for a time threatened to overshadow all the troubles which Russia has recently experienced. General Korniloff, the commander-in-chief, who had for some time been demanding that the Government take the necessary steps to restore a semblance of real discipline in the army, decided to take matters into his own hands. On Sept 5, apparently despairing of securing, under the existing regime, the drastic action which he considered essential to a restoration of efficiency in his army, General Korniloff demanded of Premier Kerensky that all power, both civil and military, be turned over to him. Kerensky indignantly refused to submit to such dictatorship, ordered Korniloff relieved from command of the armies, and called upon all loyal elements of the population to support him in his stand. The Premier assumed command of the armies himself, after his first appointees for the position of commander-in-chief had declined to accept, and summoned General Alexieff from retirement to act as his chief-of-staff.

It appeared that all the elements for a civil war were at hand and that the already sorely tried country was to be plunged into still worse difficulties. It developed, however, that Korniloff was supported by only his fellow Cossacks of the army and by a comparatively small part of the civilian population. Moreover, he had only the best interests of his country at heart, his disagreement with Kerensky being as to the necessary means for accomplishing the results which both desired. There were a few skirmishes between the supporters of the two factions, but as soon as Korniloff saw that the vast majority of the people were not in sympathy with his movement, he promptly abandoned all opposition and surrendered. A court-matrial was quickly assembled for the trial of Korniloff and his principal subordinates on the charge of high treason. Upon the announcement of the composition of the court, General Alexieff resigned his position as chief-of-staff, stating that a fair trial was impossible before the tribunal, made up, as it was, entirely of enemies of Korniloff and of his ideas of discipline. Thus has apparently ended what for a time threatened serously to menace the newly won freedom of the Russian people.

October

Altho the Germans captured Riga in the first days of September, they have been denied the fruits of their easy victory thru the fact that the Russians still controlled the Gulf of Riga. The waters of the gulf were patrolled by a Russian fleet, while entrance from the Baltic was barred by the fortifications on the islands at its mouth. Possession of the gulf was important to the Germans not only that they might open communication by sea with Riga but also that their fleet might have an opportunity to operate against the towns along its coast still remaining in the hands of the Russians. An expedition was accordingly organized to seize the fortified islands and drive the Russian fleet from the gulf.

A German fleet with a convoy of transports, said to number 100 vessels in all, suddenly appeared at the entrance to the gulf, and on the morning of Oct 12 troops were landed on the northern coast of Oesel Island under the protection of fire from the warships, encountering little opposition. Moving rapidly southward, the Germans entered the town of Arensberg on the evening of the 13th. The Russian defending forces had now been split in two. The smaller portion retreated toward the southeast in the direction of the fortifications commanding Irbe Channel, the principal entrance to the gulf, while the main force fell back to the west and crossed the causeway leading to Mohn (Moon) Island, where a German attempt to land had been repulsed.

On Oct 17 Berlin reported the capture of the Svorb Peninsula, the site of the main coast fortifications. This gave them complete possession of the island. On the 18th a force crossed to Mohn Island, quickly overcoming the resistance of the defenders and securing full control. The next day the island of Dagoe was taken with slight opposition, and the smaller islands of the group were occupied.

On the 21st German troops crossed to the mainland directly east of Mohn and seized the Werder peninsula. This move caused great excitement in Petrograd and the government made hurried preparations to remove the capital to Moscow. It was feared that the occupation of territory on the mainland presaged an intention on the part of the Germans to follow up their success with an advance on Petrograd. After a week's delay, however, the troops returned to the islands and no more offensive movements were attempted.

By this rapid and successful operation the Germans are at last in a position to reap the advantages of their recent capture of Riga. They now control the gulf of Riga and can open a line of supply by water for their troops on the northern section of the Russian front. This will doubtless be a welcome relief for it must be believed that their supply of rolling stock for the railroads is none too great. In connection with their seizure of the islands the Germans captured about 20,000 prisoners and 100 guns. Some lively naval engagements occurred during the operations, the Russian Riga fleet resisting the invaders valiantly, tho the main battleship fleet did not leave their safe haven in the Gulf of Finland. The work of the fleets will later be considered at greater length.

Little of interest occurred on other parts of the Russian front. The Germans fell back for considerable distances, fifteen miles at the point of greatest retrogression, on their front northeast of Riga. This movement seems to have been for the purpose of shortening their line and at the same time placing it more advantageously as regards natural defensive strength, perhaps with the idea of freeing some of the troops in this sector for use elsewhere. At some points along the line the Russian troops have again been fraternizing with the Germans. Every effort is being made to break up the practice, even to the extent of opening on the fraternizers with artillery.

The situation in Moldavia has remained unchanged. Each side has attempted a few minor attacks but without results.

November

There were no military operations of any kind on the Russian front during November. The political situation, however, took a turn which may have a greater effect on the war as a whole than almost any conceivable military enterprise in this theater.

On Nov 7 the Bolsheviki, or extreme radicals (literally the men who want more), started a revolt against the Provisional Government. By the 10th they had secured complete control of Petrograd and Moscow, Kerensky was in flight, and most of his Ministers were in prison. A new Radical cabinet was formed, headed by Nikolai Lenine, leader of the Maximalists. The new government announced that it proposed primarily to negotiate an immediate peace, to turn the land over to the peasantry and to convoke the Constituent Assembly.

Supporters of the Provisional Government who attempted to restore it to power by armed force were defeated and the new regime does not appear to be actively opposed at present. On the other hand, only a small portion of the country has rallied to its standard. It is supported by the armies on the northern portion of the front and by those about Petrograd, as well as by the Baltic Fleet. The bulk of the army has so far not declared itself, tho the Commander in Chief, General Dukhonin, declined to carry out his instructions to open negotiations with the enemy for the armistice. As a result of this action he was ordered relieved, but refused to surrender his command.

It is reported that the sentiment in many parts of the army is not averse to an armistice. Disorganization of the supply service has resulted in a great shortage of food in some of the units at the front, who are in danger of being forced by starvation to withdraw, if not to disband altogether.

In spite of the fact that they are as yet supported by only a small part of the country, the Bolsheviki leaders are going ahead with their peace program. They state that they will not conclude a separate peace, but as the month closed they were arranging an armistice with the Central Powers, commissioners of the two sides to meet on Dec 2. Ostensibly this is to be a first step in a movement for world peace. It is to be feared, however, that when the Bolsheviki find themselves unable to consummate a general cessation of the war on all fronts, they will decide to stop it as far as Russia is concerned at all events, even on the assumption that they are acting in good faith thruout. Many observers are convinced that most of the leaders of the new movement are German agents.

Should the Maximalists succeed in concluding a peace with the acquiescence of the Russian people, the serious effect on the Allied cause is only too apparent. Even a prolonged armistice would produce consequences not to be overlooked. The Germans would be able not only to withdraw most of the still not inconsiderable forces which they are maintaining on the eastern front, but also to secure large quantities of sorely needed supplies from the interior. An exchange of prisoners would give the Central Powers over a million men now held captive by the Russians.

Not the least deplorable result of a Russian peace would be its effect on the fortunes of Rumania. This sorely tried country, whose present plight is due primarily to the treachery of a Russian Minister, is entirely cut off from its Allies except thru Russia. Should the Russian support be withdrawn the Rumanian army in Moldavia would be in a hopeless situation and could no longer hope to resist the invaders of their country.

Tho the Bolsheviki now have the upper hand, opposition to them is not believed to be at an end. A strong patriot party, including the Constitutional Democrats and many of the Socialists who previously supported Kerensky, has gathered around the Cossack leader Kaledines. It may require the test of a civil war to determine whether the patriots or the Bolsheviki are to control the destines of Russia.

Rumania

August

In reviewing the last month of the Rumanian campaign, it is worth while to look back at the situation on Nov 10, when the final stage of the German offensive began. Up to that time they had gained important, but not decisive, advantages. Mackensen's prompt stroke in the Dobrudja, which he found defended by only two divisions, had upset Rumanian plans, gained the initiative for the Central Powers, and won as a prize the important Cernavoda-Constanza line to the sea. Falkenhayn's appearance in Transylvania had speedily disposed of the hasty and ill-advised invasion by the Rumanians; with his good lateral lines of communication, he was able to knock in turn at half a dozen gates into Rumania, and thus keep the defenders guessing as to his real objective. Just now, however—Nov 10—the German enterprise seemed to be fairly checked, with Mackensen retreating in the Dobrudja before Sakharoff's reinforced columns, and Falkenhayn marking time at the Rumanian passes.

Just what happened at this time is not entirely clear. It is certain, however, that the German column at the Vulcan Pass was heavily reinforced, that a great two-days' battle was fought near Tirgu-Jiu, some 20 miles south of Vulcan Pass, of which few details were reported, and that after this initial victory the German

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wave of advance spread over Rumania as steadily as over Serbia a year ago. By Nov 19 their cavalry, marching south along the Jiu, had struck the railroad running east from Orsova, thus cutting the line of communications for the western most Rumanian army. Two days later came the astonishing news of the capture of Craiova, the chief city of western Wallachia, and the center of the grain district. With this prize the Germans took also 300 railroad cars, and stores of ammunition and supplies.

Falkenhayn's columns were now pouring down thru all the northern passes, and along the valleys that tend southeastwardly across the plains of Wallachia. The Rumanians were desperately trying to form a line at the Alt River that might halt the invaders, when they were dismayed by a fresh peril from the south. Mackensen, whose real purpose in the Dobrudja had been accomplished a month earlier, had slowly fallen back before Sakharoff to a line a few miles north of, and guarding, the captured railroad. The Allies were greatly disturbed lest he should force a crossing of the Danube at Cernavoda. Now suddenly (Nov 24) he appeared north of the Danube, but at Zimnitza, only a third as far from Bucharest as the first-threatened point. The crossing was evidently made by ferriage, for the reports speak of the Hungarian Danube Flotilla and the Imperial Motorboat Corps.

Two days later the "Army of the Danube" had gained contact with the "Ninth Army" from the north. United, they formed a vast curve stretching from Campulung on the north around thru Slatina to Giurgevo on the south. Orsova had fallen on the 23rd, and the Danube, crossed at several places, was under the Teutons' control as far east as Giurgevo. The threatening circle contracted with ever-increasing pressure. Pitesci was taken on Nov 29, and thence Falkenhayn's main body marched straight down the Arges River upon Bucharest, while von Morgan, advancing from Campulung, threatened the Allies' right flank.

The Rumanian Government (the sixth of the Entente Allies to be thus displaced) had been removed on Nov 27 to Jassy. On Dec 3, an attempt was made to save the threatened capital by despatching Russian forces in a counter-attack against the Danube army southwest of Bucharest. German cavalry succeeded in frustrating this move. The entire Rumanian line collapsed. Bucharest, which, with its thirty-six concrete and steel forts, is the second largest fortress in the world, offered little resistance to Mackensen's columns, which entered the city on Dec 7. On the same day, the Ninth army took Ploesci, the center of the oil district, and a prize perhaps more valuable to the invaders than the capital. In their disorganization, the Rumanians had lost in one week 30,000 men and 90 guns.

The pursuit never faltered. Altho the flooded Jalanitza River seemed to offer a favorable defensive line, the invaders swept across it before it could be fairly occupied. About this time (Dec 8) a considerable Rumanian army under her able General Averescu, which had been successfully holding its front at Sinaia, was struck on its flank and rear and cut to pieces. On Dec 12 was reported the capture of Mizil, on the railroad from Ploesci to Buzeu; the attack in this direction was pushed under the most unfavorable weather conditions, so as to pierce the Buzeu line, and give the Rumanians and Russians no time to form here. This object was achieved on Dec 15 with the capture of Buzeu, and the occupation of the country to the immediate northeast. The appearance of Russian cavalry in the vicinity of Rimnicu-Savat was the signal for a relaxation of the pursuit in this direction. The Russian line appeared to be forming along the general line of the Sereth River, including the fortified cities of Braila and Focsani.

Meanwhile the center of activity was shifting once more to the Dobrudja. On Dec 10, a Bulgarian force had crossed the Danube east of Silistria and marched against Fitesci, which was occupied shortly afterwards. As the Allied troops west of the Danube fell back, General Sakharoff's right flank resting on the river, was thereby exposed, and he was compelled to retire also. This retreat, which commenced on Dec 15, was continuing on the 20th with every indication that the Allies would be compelled to give up the territory south of the Danube altogether.

The material gains of the entire Rumanian campaign have lately been thus summed up in a despatch to the *New York Times:* "Approximately half of Rumania has been conquered while the Rumanian losses are estimated to date at more than 300,000, including more than 150,000 prisoners. The Rumanian officers' corps has been practically wiped out. It is estimated that more than half of the Rumanian army's artillery is in Mackensen's hands, including more than 400 field guns and nearly as many machine guns, as well as 200,000 rifles which have been picked up. More than 2000 kilometers (about 1250 miles) of Rumanian railroad, which is more than two-thirds of the country's whole railroad system, are in German hands. Mackensen has accounted up to date for more than 4000 Rumanian freight cars and some 130 locomotives. The Danube has been cleared to the southeast of Bucharest and navigation as far as Cernavoda is about to be resumed. Thanks to the speed of the Rumanian retreat, vast stocks of cattle, grain and petroleum have been captured. The grain harvest of 1915 purchased by England, is intact in the warehouses, while this year's harvest has not even been thrashed yet and is still untouched thruout the land. At least 1,000,000 head of cattle, 2,000,000 sheep and goats, and 300,000 pigs remain in the occupied territory."

January

A month ago the Russians were just taking up their strong position in front of the Sereth, which included the important cities of Focsani, Braila, and Galatz. The armies of the Central Powers were advancing in three well-defined movements—the Ninth Army along the Buzeu-Rimnicu Sarat line, the Danube Army just west of the Danube toward Braila, a Bulgar-Turk army thru the Dobrudja.

For several days, attention was focussed on the Dobrudja, while events elsewhere stood still. General Sakharoff, the Russian commander, fell back to a new line, close to the Danube delta, the third position the Russians had attempted to hold (their first having been south of the Cevnavoda-Constanza Railroad, the second

the line from Hivsova across the Isthmus). This new line proved equally vulnerable to Bulgar attacks. After a brief campaign that involved the rout of a Cossack division, the Russian left had been forced back, and the way to the Danube cleared over the front from Tulcea to Isaccea (Dec 24). All that was left to the Russians was a ten-mile corner protected by the bridge-head at Macin, and well fortified.

Meanwhile the Ninth Army had been lightly engaged in a mere holding attack in front, while Mackensen developed a new direction of attack down the Buzeu River, from Buzeu toward Braila. On Dec 26 the advance against the Rimnicu position was resumed, and after a five days' engagement the attackers broke thru a line fortified with trenches and barbed wire. The capture of 10,000 Russians was announced on Dec 28.

Meanwhile a new offensive was developing which constituted a *fourth* and important element in the campaign. It had to do with the numerous little river valleys that lead down from the Carpathian divide into the plain of the Sereth. The Russian diversion in this region, early in December, had left these mountain passes for the most part in Russian hands; nevertheless here came the Germans, under such leaders as von Morgen and Krafft von Delmensingen, scaling the mountains in the dead of winter, carrying their food and ammunition largely (it is reported) on their backs, pouring thru the Oitoz Pass and other defiles into Moldavia. Their appearance in the Putna, the Susitza and other valleys, northwest of Focsani, at once constituted a serious menace to the Russian right flank.

The next Teuton success was reported from the Dobrudja. After an attack lasting ten days, the Bulgar army took Macin on Jan 3, the Russians fighting from house to house in their retirement. With the fall of this last key position to their hold on the Dobrudja, there was nothing left for the Russians except to abandon the latter entirely. Retreating across a ponton bridge close to Braila (there are no permanent bridges north of Cernavoda), they apparently left the bridge intact, for their assailants followed close on their heels. Braila, commanded by the enemy's guns across the Danube and beset by attacking columns from the south and west, was now in a hopeless position and was abandoned on Jan 4. The loss of this city of 60,000 is a serious one; altho a hundred miles from the sea, it is virtually a seaport and an important shipping center.

Despite the vigorous resistance of the Russian troops about Focsani, the converging attack of the Germans—from southwest, west and northwest from the Carpathians—was too strong to be denied. The Ninth Army took the city on Jan 8, and captured during the operations some 5500 prisoners. Focsani is a city of 30,000 inhabitants.

On Jan 11, the Russian line ran from the Carpathians down the Trotus River to a point near Tergu Ocna, thence southeast across several streams to the Putna, following this stream into the Sereth, and so on down to Galatz. This latter city is the last stronghold left to the Allies upon the Danube, and a supporting point for the whole Sereth line. Almost all of the southern bank of the Sereth had passed into the enemy's possession, and on Jan 13, a Turkish force, operating north along the railroad from Braila, stormed Vadeni, only six miles from Galatz. The latter city was seriously threatened, and the Russians, thoroly awake now to their danger, made the first successful counter-stroke for some time, and retook Vadeni. Simultaneously with this report came others of successful Russian resistance farther west. As the month closed, it appeared that the Russians were, for the moment at least, rather better than holding their own.

The Rumanians themselves have been little heard from during the past month, except for some fighting in the river valleys leading from the Carpathians. Their total losses are probably not far from 300,000 men. Those who have been saved from the wreck—probably not over 200,000—have presumably reached zones of safety well behind the Russian lines; but these troops will hardly be in better condition than the Serbian army which escaped last year thru Albania.

February

The last successful attack of the Teutons on the Rumanian front resulted in the capture of Nanesti on the Sereth on Jan 19. This gave the invaders command of the Sereth from the mouth of the Putna to the vicinity of Braila. From the Carpathians to the mouth of the Danube, they now hold an unbroken river bank, save at Vadeni, where the Russians maintain a bridge-head on the south bank. But they have progressed no further. A Bulgar force which crossed to a point on the Danube delta opposite Tulcea (Jan 23) was overcome the following day, and lost 300 men. Severe cold in the Carpathians was reported as the reason for the slackening of the offensive there. About this time, however, the withdrawal of the select German divisions on this front began to be rumored. The Bulgars and Turks, it appeared, were to be left to guard the Sereth line.

Despite the extreme cold in the Carpathians, the Russians assumed the offensive on Jan 27, and by an attack along the Kimpolung-Jacobeni road, on the Rumanian-Bukovinian border, forced back the Austro-Hungarian front for a short distance on a front of two miles. In this operation Petrograd reported the capture of 1158 men. The Russians had to advance against barbed wire and fire from trenches, thru snow that was waist deep in places. The response to this offensive came on Feb 12, when the Teutons attacked in this same region, along the Vale Putna road. After two days of fighting, the Russians were forced to withdraw toward Jacobeni. Russian prisoners numbering over 1200 men were taken, according to Berlin, with three cannon and twelve machine guns. Raiding operations in the mountains continued thru the middle of February. British armed motor cars are operating with the Russian forces at the mouth of the Sereth river, according to the Petrograd statement of Feb 13, and French aviators are with the Russians in Moldavia.

At the close of July General Averescu's Rumanian army was in the midst of a successful offensive which

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had been inaugurated a week earlier in the neighborhood of the upper Putna and Suchitza rivers, where the Rumanian line turned northward parallel to the Transylvania border. In the first days of August the Germans succeeded in bringing the Rumanian effort to a halt. They at once began offensive operations in their turn, selecting for their points of attack the flanks of the sector of Rumanian activity. One force attempted to push forward in the vicinity of Oituz Pass and the Trotus river, in an effort to get behind the troops defending the lines farther south. While this force has succeeded during the month in making some slight gains, their advance has been so slow that it has had no practical effect on the campaign. At the same time this attempt was started, General Mackensen's troops began a northward movement from Focsani, advancing along the west bank of the Sereth. By the 10th they had moved forward some ten miles in spite of desperate resistance, and had forced a crossing of the Suchitza on a wide front on both sides of the railroad. On the 13th they occupied Pantziu and in the next few days pushed a column northwestward into the mountains.

The Rumanian and Russian forces on the upper reaches of the Suchitza and Putna at the scene of their recent success were now in a serious predicament with their means of egress to the valley of the Sereth blocked by the enemy. They were forced to retreat across the mountains and large numbers of them were captured before a junction with the main defending army was made. The Rumanian troops at this stage developed a surprising defensive power, stopping the German advance and even recovering some of the ground lost, tho not any material amount. During the rest of the month there was little change of positions to show for the severe and almost continuous fighting. Most of the attacking was done by the Germans, but the Rumanian lines held fast with a few minor exceptions where the attackers made slight but unimportant gains. Two Russian regiments holding a part of the line near the village of Muntelieu abandoned their positions and fled in the face of a German attack, losing many prisoners and imperilling adjacent sections until the gap was stopped by Rumanian reserves. This defection of the Russian troops accounted for the only considerable success attained by the Germans after the first force of their offensive movement was expended and their rapid advance halted.

September

The situation in Moldavia has remained unchanged during September. Since the first rapid advance of Mackensen's troops northward was stopped by the Rumanians, there has been no material alteration in the positions. The Germans made a few weak attacks during the month but with no success. The Rumanians and Russians, on their part, made some slight, but unimportant gains, thru counterattacks delivered at different points in the sector. The heaviest of these minor assaults were made in the Ocna region, south of Grozechti, and in the vicinity of Varnitza and Muncelui. None of these were of sufficient importance to warrant more than passing mention.

THE SOUTHERN THEATER

On both Italian fronts, the month has been characterized by considerable artillery activity, with few troop movements. The situation on the Carso remains unchanged. Operations have been hindered by the heavy snowfalls, and the low temperatures in the mountains. Airplanes have been active, and an aerial battle occurred above Tolmezzo in which the Italians claimed to be victors.

January

The guns speak loudest on this front. Little else except artillery bombardments has been reported, the Italians incessantly endeavoring to harass their opponents in this way, particularly on the Carso Plateau.

"On Dec 27 the Italian War Minister, General Morrone, according to a Rome despatch, was questioned in the Italian Chamber as to steps taken by him to meet an apprehended Austrian offensive, thought to be in preparation for the early spring."

February

Altho Italian artillery has been active, as usual, thruout the month, the initiative as to infantry operations has been entirely with the Austrians. Their persistent and frequent raids and small attacks have resulted in the capture of not a few prisoners, the largest single haul being made in the Gorizia region on Feb 9, and comprising 665 Italians. One of these attacks was made thru tunnels in the snow, affording a concealed approach to the Italian trenches.

The visit of General Nivelle to Italian headquarters, Feb 1-4, is noteworthy as illustrating the effort being made to secure a more unified co-operation among the Entente leaders.

March

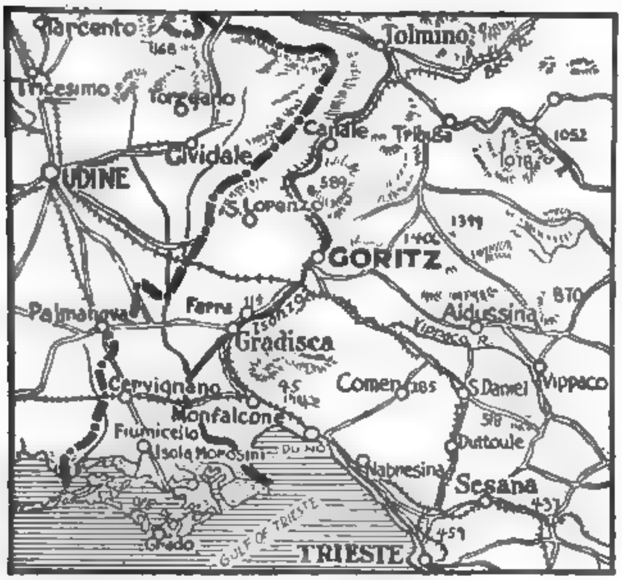
The Austrians have continued this month their system of frequent and simultaneous raids, which cause the Italians no little annoyance and yield a considerable number of prisoners. Only one Italian offensive is worthy of note, that directed against the Austrian positions in the Venetian Alps, on the eastern border of the Trentino. On Mar 4 the highest summit of the Costabella group was seized, but the subsequent fighting led to no decisive results, nor does the occupying of this position open any route for the Italians into the Trentino.

April

The "minor warfare" on this front appears particularly diminutive in contrast with the reports from France. Austrian activity on the Carso, on the one hand, is offset by Italian initiative in the Trentino, where their artillery has gradually acquired a predominance, and is able to reach many points within the Austrian lines. Airplane raids are becoming more frequent on both sides; the Austrians have been particularly active in the Trentino. There are no definite signs of an approaching offensive on a large scale.

May

What seems to have been the main objective of the Italian offensive was not disclosed in the first ten days. During this time the fighting was mainly in the Plava district, north of Gorizia. Between this city and Tolmino, some 20 miles to the north, the Austrians had retained a strong ridge of hills, parallel to and commanding the Isonzo. The Italian artillery opened upon these positions on May 12, and kept up its bombardment, answered by the Austrian guns, until the 14th.



The infantry then advanced, crossing the wide Isonzo, itself no mean obstacle, by means of ponton boats, against these hill positions.

Three miles north of Gorizia lies Monte Santo, and beyond are Monte Vodice and Monte Cucco. These three hills, some 2000 to 2500 feet high, form the pillars of the Austrian defensive. Against Monte Cucco the opening attack was directed, and the Italians were soon in control of its summit. Monte Vodice, where the fighting centered on May 18, was a more serious problem; here the Austrian counter-measures were particularly vigorous, and their rocky shelters, supplied with machine guns, very formidable. "The fighting," comments the *Army and Navy Journal*, "was over ground somewhat kindred in character to the Devil's Den, on Little Round Top, but fortification had added to the natural difficulties, while the artillery, on the other hand, offered the attacking party an aid which it did not have in the Devil's Den struggle. The Italians captured on the mountain two 4-inch guns, two 6-inch mortars and a number of machine guns with ammunition." Similarly Monte Santo was attacked, and Italian gains recorded. About this time came the news of an Austrian diversion in the Trentino, at separated points in the Adige and Sugana valleys. The defensive positions elaborately constructed by the Italians on the frontier now stood them in good stead, and this attempt to discourage Cadorna's offensive made little headway.

After ten days of fighting in this sector, the Italian attack suddenly shifted to the Carso (May 24). On the 13-mile front from Castagnieviazza to the sea, they struck unexpectedly and hard, penetrating the hostile lines to the depth of a mile. This attack succeeded an artillery bombardment of 10 hours, and won 9000 prisoners and the village of Jamiano. Here for the next week the attacking troops kept up the pressure, creeping along the coast close to Duino, a small port that lies a dozen miles west of Trieste. The narrow coast-belt here affords little opportunity to operate against this town, while close behind it rise the protecting heights of Monte Querceto. This hill position, it would seem, must be turned before the little port is taken, tho the Italians are only a mile from the latter place, at San Giovanni. The advance across the rugged Carso plateau is slow over the dirt roads which alone traverse it. The present Italian line runs close to Medeazza, and touches the western edge of Castagnievazza, which the Italians failed to capture.

The material assistance rendered the Italians by English guns and English support have previously been noted. Another factor that has contributed largely to Italian success is the excellent system of communication and supply. General Maglietta, Cadorna's chief engineer, aided by 200,000 workmen, is reported to have covered the entire front with a net-work of roads.

So far, Trieste is not seriously threatened, nor has the present rate of progress anything of alarming significance to the Austrians. The latter have had time to stiffen their lines by reinforcements, and their losses of 25,000 prisoners are in large part offset, if the Austrian report be true, by their capture to date of some 15,000 Italians.

June

The close of last month saw the Italian offensive, which, during its three weeks duration had netted appreciable gains north of Gorizia and on the Carso, slowed up and finally stopped by Austrian reinforcements. It soon developed that the Austrian army on the Carso had been heavily strengthened, largely by troops withdrawn from the Russian front, but also by transfers from the Trentino and by new formations from the interior.

On the night of June 3, after a heavy three days' bombardment, the Italian lines were assaulted at different points from San Marco, east of Gorizia, to the coast. After several slight successes, the Austrians recorded their crowning achievement on June 5, when they recaptured a line of trenches south of Jamiano previously occupied by the Italians, and with it 6500 prisoners. Their advance at this point threatened the Italian right flank at Giovanni and precipitated heavy artillery and infantry combats. On the 6th the total number of prisoners taken in three days was announced to have been over 10,000, including an Italian field hospital and practically all the effectives of three regiments, captured at one time.

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The Austrian counter-offensive, thus formidably begun, failed to make any further progress, but the aspect of affairs in this sector has been entirely changed. Altho the Italians retain most of the ground they gained, the significant fact is that their advance toward Trieste has been definitely halted. In the two operations each side took about 25,000 prisoners and the losses appear to have been just about balanced. During the remainder of the month nothing but minor enterprises and readjustments of positions occurred on this front.

With the evident intention of profiting by Austria's attention being drawn to the Carso region, the Italians, on June 9, and on several days thereafter, instituted surprise attacks at various points in the Trentino section. These efforts, many of which met with considerable local successes, were particularly directed against the heights dominating the Suzana valley, which affords the natural line of advance upon Trent from the east. It was here that the Austrians reacted most vigorously against the pressure. On the 29th they recaptured Mt. Ortigara which the Italians reported having taken on the 20th.

July

No operations of any importance took place on either of the Italian fronts during July. On the 6th an Italian surprise attack gained a little ground northwest of Selo on the Carso. A trench raid near Versic gave them 275 prisoners on the 15th. The Austrians made an attack in considerable force east of Gorizia on July 14, but were repulsed. Artillery exchanges, quite severe at times, were reported at intervals thruout the month, but there were no other actions except the usual trench and reconnoitering raids.

August

For the first half of the month the Italian front showed no more signs of activity than in the two months immediately preceding. Suddenly, with practically no warning, there was started an offensive that eclipsed that of the late spring. The operations extended over a front of more than thirty-five miles, from the Adriatic northward to Tolmino. The heaviest attacks have been between Tolmino and Gorizia, where the plateau in the great westward bend of the Isonzo afforded the Austrians a position flanking all the avenues of advance east from Gorizia and preventing any formidable movement in that direction. During their period of seeming inactivity, the Italians had concentrated on the Isonzo front an overpowering weight of artillery, said to number in the neighborhood of 6000 guns. A number of the heavy pieces were furnished and manned by the British.

On Aug 18 there began an artillery preparation all along the front surpassing in intensity anything previously seen in that region. This fire was continued for twenty-four hours. Aided by a dense fog, the Italians threw a number of bridges across the Isonzo, especially in the vicinity of Canale and Anhovo, about half way between Gorizia and Tolmino. The river was crossed and the attack started on the morning of the 19th. It met with immediate success. Canale and the surrounding villages were taken and the attacking troops pushed on eastward, spreading to the north and south, where they were joined by those who crossed the river on the flanks. As soon as this movement was well under way, simultaneous attacks were started on the Carso, particularly toward the south near Selo, where the last Carso offensive was stopped. Selo was captured and other gains were made a little farther north. The pressure on the Carso was kept up thruout the remainder of the month. Only a few slight gains were recorded, but the Austrian troops holding the lines, with their reserves, were immobilized and prevented from assisting at the scene of the main attack north of Gorizia. The heaviest fighting in the south was directed against the Hermada Mountains, a rather low, rugged hill mass separated from but flanking the Carso on the south and effectually barring the direct advance along the coast toward Trieste. The Austrian positions on these mountains were bombarded from the west and north by land batteries and from the sea by the heavy guns of British and Italian monitors. The attacking troops advanced some distance up the slopes of the mountains, but at last reports the Austrians still held the summits firmly.

In the meantime the main attack south of Tolmino had been making steady progress in spite of the determined opposition of the Austrians. The theater of these operations is a rough tract of elevated land known as the Bainsizza plateau, which occupies the whole bend of the Isonzo river and extends several miles to the eastward. South of the Bainsizza plateau and separated from it by a narrow valley is a sharp range of hills surmounted by several peaks, the most important of which are Mts. St. Daniels, St. Gabriele, and Monte Santo, in order from east to west. These mountains command both the Bainsizza plateau and the Vipacco valley, extending eastward from Gorizia.

Following up their first successes, the Italians pushed forward on the Bainsizza plateau past the northern slopes of Monte Santo and soon threatened its approaches from the east. Seeing their line of retreat in danger of being severed, the Austrians abandoned Monte Santo on Aug 24 and it was at once occupied by the Italians. By the end of the month a number of positions on the northern slopes of Mt. St. Gabriele had been taken and that height was seriously threatened. Farther north the Italians had deflected their left flank toward Tolmino and were approaching that city from the south. Most of the Bainsizza plateau is now in Italian hands. A report on Aug 30 stated that the whole plateau had been ocupied and that the Italians had entered the Chiapovano valley. Later reports, however, told of fighting on the plateau, so the exact situation is not apparent. The movement is not yet at an end, however, and the position of the Austrians seems to be very disadvantageous. Thru the Chiapovano valley, which is certainly threatened if it has not been reached, runs the only remaining direct road between Tolmino and the Carso. If that should be taken, none but very round-about means of communication are available and the two parts of the Austrian army would be completely isolated from each other for all practical purposes.

The Austrians on the Trentino front endeavored, by means of numerous local attacks at different points, to divert the energies of their enemies from the Isonzo. None of these attempts met with noteworthy results.

September

The Italian offensive on the Bainsizza plateau, begun on Aug 19, was continued during September, tho with no such rapidity of advance as was recorded in the first days of the operation. The principal interest for the past month has been centered in the struggle for Mt. St. Gabriele, which the Italians were just beginning to threaten seriously at the end of August. The Italian artillery was able temporarily to isolate the mountain by firing on its eastern approaches, while the infantry slowly forced their way up the north and west sides. By Sept 4 the crest of the mountain had been nearly gained and its capture seemed imminent, as the defenders were effectually cut off from reinforcements and supplies by the intense fire on their lines of communication. At this critical juncture, the difficulties of transportation across the rugged country to the Italians' rear made themselves manifest in a diminution of the ammunition supply and the gun fire had to slacken. Austrian reinforcements were rushed to the mountain and the Italian advance was checked. For the next two days the struggle raged fiercely. On the 7th the Austrians launched a counterattack with the assistance of some divisions, including one of Turkish troops, sent from the eastern front. The Italians were forced back about half way down the slopes of St. Gabriele, but succeeded in holding their own at that point, preventing further Austrian advance. There succeeded several days of continuous and most severe fighting in which neither side secured any marked advantage. The Italians finally gained a partial ascendency, in spite of their enemy's more advantageous position, and once more forged slowly ahead up the rugged slopes of the mountain. Recent reports have been so vague and contradictory that it is difficult to decide what the exact situation is at the present time. It appears, however, that the Italians now hold the entire northwestern slope, to and including the summit, together with most of the contiguous ground on the western and northern sides of the mountain.

On the Bainsizza plateau proper, the Italians spent most of the month in organizing the positions won in the first part of the offensive. This process was accompanied by many small local attacks made for the purpose of straightening out the original lines and reducing enemy positions which would prove particularly disadvantageous to a resumption of the offensive at a later date. Few of these operations were of more than local importance, but in the aggregate they involved a considerable amount of fighting. The Austrians developed a number of counterattacks, some of them of great strength, but they were uniformly repulsed.

On Sept 29, the Italians started an attack on the southern part of the Bainsizza plateau, which, while only local in extent, may well prove of great strategical importance if persisted in. By means of this attack the Austrians south of the village of Bainsizza were driven back about a mile into the southeastern corner of the plateau. It is at this corner, where the Chiapovano valley turns west after coming down south from Tolmino, that we find the northern end of the road which forms the last connecting link between the northern and southern Austrian armies. Should the Italians succeed in penetrating to the valley at this point, the two wings of their enemy's forces will be separated, except for very round-about means of communication. The Italian lines on the Bainsizza plateau are now well to the east of Mt. St. Gabriele, as are also those on the Carso to the south. It seems not improbable that the Italians have abandoned direct attacks against the mountain and are endeavoring to enclose it in a pocket which can later be snuffed out with comparative ease. This same system might well be extended to include Mt. St. Daniele, a short distance east of Gabriele.

On Sept 7, at the same time that they attacked on St. Gabriele, the Austrians counterattacked on the southern Carso. According to reports from Vienna, they succeeded in driving the Italians from the positions they had secured on the slopes of the Hermada heights. At all other points the Italians repulsed the attacks and retained possession of their previous gains. From this time to the end of the month the Carso was essentially quiet, both sides concentrating their efforts on the main operations farther north. The Austrians have greatly reinforced their forces on the Isonzo front. They have transferred to the Italian theater practically all the troops they had in Rumania and Bukowina, and have considerably reduced their strength on the Russian front farther north for the same purpose. It is evident that the latest Italian effort has awakened the liveliest anxiety in the minds of the Austrian higher command and that all possible steps are being taken to prevent any further extension of the Italian gains. It is known that Turkish troops have been in action on the Isonzo, while it has been reported that several German regiments were on their way to the same front.

Neither side has engaged in important movements in the Trentino sector, tho the Austrians have continued their efforts of the previous month to create diversions by means of numerous minor attacks at various points on the front. Toward the close of the month a number of these attacks were delivered in the western portion of the front, in the vicinity of Mt. Adamello and the Camonica valley, the first activity here for months.

October

The Allied countries have come to expect from Italy either good news or no news at all. The Italian operations for the recovery of "Italia Irredenta" have been spasmodic and the intervals between successive blows have been long, but in practically every case ground once gained has been held securely and made a stepping stone for the next advance. If sometimes impatience has been expressed at the slowness with which the campaign developed, it has been quickly remembered that the Italians were oper-

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ating in the most difficult terrain of any of the fronts, that their supplies of guns and shell have always been most restricted, and that they had no steel from which to augment their munitions. The Isonzo lines have moved slowly but each movement has been an advance. As a result of the last stroke the Austrian armies found themselves in a serious situation. Another comparatively slight advance on the part of the Italians and the Austrian forces would be cut in two. The situation presented so much of danger that the Germans were forced to come to the rescue, sending men and guns to the Isonzo front for the first time since the entry of Italy into the war. The Austrians, too, brought up every available man, stripping their other fronts bare. The stage was thus set for the delivery of a staggering blow at the Italians, snatching from them the victory which they had almost within their grasp and forcing them to relinquish in a week more than they had gained since their armies took the field.

Before considering the disaster in detail it may be well to review briefly the situation of the Italian lines on this front. The line was broken at three points by the Isonzo River, here a swift mountain stream flowing thru a deep, narrow gorge in a series of great bends. Beginning at the north, the Italian positions first touched the river just northeast of Plezzo (Flitsch), where they crossed to the left bank, recrossing between Caporetto and Tolmino and again just south of the latter city. From here the line passed over the Bainsizza plateau and Mt. St. Gabriele to the Carso and thence to the sea just west of Duino. The great bulk of the Italian forces and especially of their artillery was concentrated on the part of the front between Tolmino and the sea, the portion of the line that has been the scene of all the recent fighting. Unfortunately the Italian mind seems also to have been concentrated on this section to the exclusion of that farther north. The Central Powers must have taken weeks to collect on the short front of attack the overpowering masses of men and artillery with which they struck and the warning should have been sufficient to indicate the steps that would be necessary to prepare for the blow when it came. Indeed the Italian reports have frequently mentioned of late that large enemy forces were being concentrated opposite the northern end of the Bainsizza and north of Tolmino. What this concentration portended was, however, apparently not foreseen, or rather not properly guarded against.

The attack opened on Oct 24, following a short but very destructive bombardment, on the front from Plezzo to Santa Lucia, an important bridgehead south of Tolmino. It met with immediate success, particularly on the flanks. Protected by a heavy artillery fire, the Germans rapidly crossed large forces at Santa Lucia and drove back the Italians on the western bank of the river. One column pushed south along the Isonzo and soon severed the Italian connection with the army on the Bainsizza. The line had in the meantime been similarly broken at Plezzo and the Italians on the east side of the river in the Mt. Nero sector found themselves being slowly forced back in front while the enemy was closing in on the other bank on their line of retreat. They fell back hurriedly and endeavored to cross the river at Caporetto before it was too late. Many of them succeeded but thousands were captured and they were forced to abandon all of their guns. The Germans entered Caporetto on the 25th and the next day stormed the heights to the southwest, gaining the edge of the great Fruili plain. Advancing rapidly, they occupied Cividale, on the road to Udine, on the 27th.

While the main attack was being delivered in the north, the Austrians made a secondary and holding attack on the Bainsizza. This effort was repulsed, but the failure of the Italian forces on the left to hold their ground exposed the defenders of the Bainsizza to danger from the rear and forced them to withdraw hastily. The retirement began on the 25th and was carried out successively by all the troops from north to south. Gorizia and the Carso were held until the next day, when they too were abandoned and all Italian forces found themselves west of the Isonzo. From here on the retreat was an orderly, well conducted movement, but it was continuous and rapid. The Germans occupied Udine, the former Italian headquarters, on Oct 29. without opposition.

The Tagliamento river marks the line on which the Italians are forming to resist any further advance of the Teutons. This stream, with its north and south course, offers excellent opportunities for defensive purposes. The closing days of the month saw some slight engagements east of that stream. These were reported by Rome to be only rear-guard actions for the purpose of securing time for the proper dispositions of the main forces behind the river. Practically all of the Italian armies have now reached their positions behind the Tagliamento with the exception of the forces on the extreme south, who started to retreat after those farther north.

The Italians north of Plezzo also found themselves forced to retire as a result of the break in the line. Several miles of the front which extended westward from Tarvis thru the Carnic Alps have been abandoned, the troops falling back behind the upper reaches of the Tagliamento, where it bends to the west. As the month closed, the enemy who had pushed forward thru the mountains were attempting to turn the flank of these new positions.

The Germans state that they have captured 180,000 prisoners and over 1500 guns in these operations. It is stated from Rome, however, that these claims must include laborers, civilian prisoners and machine guns, as their losses of effectives have not nearly approached these figures. Whatever the truth may be, there can be no doubt that the Italian losses must have been enormous, both in men and guns, to say nothing of supplies and ammunition. The

losses in guns and ammunition are the most serious. The Italians have from the beginning had more men than they could use, their great lack being guns and munitions. What their condition in that respect may be as a result of the present disaster cannot at once be told, but they must feel their losses keenly. The Western Allies are rushing reinforcements, especially artillery, to their aid as rapidly as possible. The great danger now appears to be that sufficient assistance cannot be gotten to them before they are forced to bear the brunt of the overwhelming German attack in their present weakened condition. Should the Tagliamento line be pierced the Italians must fall back to the Piave river, surrendering another large section of the fertile Venetian plain.

November

The Austro-German blow against the Italians, begun on Oct 24, continued to progress for the first half of November, but was then brought to a stop, temporarily at least. The Italians made their first attempt seriously to retard the advance of the invaders on the line of the Tagliamento River, as was noted in the last review. A stand here was essential to the successful execution of the other features of the retreat. The troops in the mountainous region to the north were in danger of being cut off if the enemy continued his rapid westward movement across the Venetian plain, as their retirement was necessarily slow. The Third Army, which had been the last to take up the retreat and which was falling back along the seacoast, also needed time to enable it to reach a position abreast of the center. A further important reason for delay was the necessity for putting into as good a defensive state as possible the line of the Piave, which had been selected as the new Italian position.

By the last of October the retreating armies were all behind the Tagliamento except for a few weak forces holding bridge-heads on the eastern bank. The pursuing Austro-Germans quickly reduced these bridgehead positions, and by the first of November had cleared the entire east side of the river. Finding that the river line was strongly held, they made no serious attempts to force a crossing, but waited for their heavy artillery to reach the scene.

The reinforcements which were dispatched by the French and English did not arrive in time to assist at the Tagliamento. The Italians were, however, assisted by the weather conditions in their defense. Heavy rains filled all the streams of that section bank full, materially retarding the enemy's operations. This respite lasted but a few days and the floods subsided coincident with the arrival of the invaders' heavy guns. With the assistance of their artillery, a mixed force of Germans and Austrians gained the west bank of the river in the vicinity of Pinzano on Nov 4. This was quickly followed by other crossings farther down stream. The Italians at once abandoned the whole river line, offering very little further opposition. The retirement was made directly to the westward, where the Livenza River approximately parallels the Tagliamento. No determined resistance was made at the Livenza, the Italians contenting themselves with holding up the leading troops of the pursuers until the arrival of the main forces. They then destroyed the bridges across the Livenza and continued their retirement to the Piave. Defensive works had been prepared along the latter stream with the idea of trying to bring the movement to a definite stop.

By Nov 10 the invaders were in position on the eastern bank of the Piave from the mountains to the sea. Here they once more paused to await the arrival of their heavy guns. It was stated by Berlin that up to this time over 250,000 men and 2300 guns had been captured.

To add to the difficulties of the Italian situation another grave danger now arose on the Trentino front. Coincident with the retreat in the lowlands, the positions in the Carnic and Dolomite Alps were given up as far west as the Colbricon, north of the Sugana valley—a total length of front of about 95 miles. The mountain positions between the Colbricon and Lake Garda were still held, protecting the rear of the Piave line. The possibilities for outflanking the main Italian position by breaking the line in the mountains were not overlooked by the Germans. During the latter part of October and the first days of November reports from Switzerland mentioned the passage of numerous troop trains into the Trentino region.

On Nov 4 and 5 attacks were delivered on this front, but by small forces whose efforts were easily repulsed by the Italians. On Nov 9 there began a more determined attempt to pierce the Italian line. The left of this new attack forced its way down the Val Sugana, while the right worked over the Alpine divide and captured the town of Asiago. From this point there are practicable routes southward along the Brenta and Astico rivers, twenty to thirty miles west of the Piave, to the country west of Venice. It was evident that if this new threat could be carried into execution the Italians would be compelled to evacuate the Fruili plain as far west as the Adige. They accordingly opposed a determined resistance to the German offensive in an effort to check it before the main line should be compromised.

Fierce fighting ensued in the vicinity of Asiago and in the Sugana valley to the northeast. Despite the heroic defense, the Germans continued to gain. By the middle of November they had considerably extended their holdings around Asiago and had pushed all the way thru the Val Sugana, reducing the fortified heights along the valley and capturing Primolano at its foot, as well as Fonzaso farther north.

In the meantime, the right wing of von Bülow's forces advancing from the east had met with considerable successes in the region of the upper Piave. Driving the Italians from the left bank, they quickly forced their way across the stream at Belluno and began working south along the right bank. At this juncture an Austrian force advancing from the Venetian Alps came upon the rear of the Italians, 14,000 of whom were captured. On the 13th the Austro-Germans entered Feltre and gained contact with their com-

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patriots who had come down the Val Sugana. On Nov 16 the latter force captured Cismon at the fork of the Cismon and Brenta rivers. The troops who had occupied Feltre pushed on to the south and, on the 18th, took Quero, only five miles from the open plain. These successes gave the invaders a continuous line running approximately east from Asiago to the Piave.

At this critical moment the Italian defense stiffened and the Austro-German advance was checked. The remainder of the month saw an almost continuous succession of furious attacks, none of which made material gains. In the instances where the Italian lines were pierced the positions were restored by means of counterattacks. The failure of this operation to attain its main strategical goal, after its startling initial successes may be attributed to a number of causes. The supply lines are distinctly unfavorable to the Austro-Germans. They must experience considerable difficulty in bringing up the absolutely essential supplies, to say nothing of the enormous quantities of ammunition for large caliber guns so necessary to offensive operations in terrain of the character of that in which they now find themselves. The ground now occupied by the Italians is such as to offer great difficulties to the attackers. The numerous abrupt heights must be taken by separate assaults, while the defense has other similar heights in rear to which it may retire if driven from the first positions. Finally, the Italian First and Fourth Armies, which are confronting the attack in this sector, were not so severely tried in the earlier stages of the campaign as were the other armies, which bore the brunt of the retreat thru Venetia.

While these events were proceeding on the northern flank, the forces on the main line of the lower Piave were not idle. The invaders opened their bombardment on Nov 11 over a front of about thirty miles. On the 12th they succeeded in throwing several battalions across the river at Zenson, about eight miles upstream from the mouth. The Italians were unable at the time to drive this force back, but managed to prevent its reinforcement or the extension of the bridgehead. A few days later the position was retaken by the Italians, most of the garrison being either killed or captured. On the 13th, however, a second crossing had been made at Grisolera, between Zenson and the sea. The troops who crossed here cleared the west bank of the Piave to its mouth and pushed forward to Piave Vecchia, at the base of the peninsula separating the Adriatic from the lagoons east of Venice. This gave them a position within ten miles of the city. This success was of only short duration. The Italian engineers succeeded in flooding the entire area west of the lower reaches of the Piave, making movement in that section practically impossible and forcing the invaders to retire to the river bank. Nothing of importance occurred during the remainder of the month. The heavy bombardments were kept up and numerous desperate attempts were made to force crossings at points where they could be followed up advantageously. All of these efforts were stopped by the Italians.

The immediate menace to Italy seems to be past. The reorganized Italian armies have recovered from as could be asked of any troops. Their lines are now their partial demoralization and are fighting as stiffly less than half as long as they were before the retreat and they have ample forces to man them adequately. Even their heavy losses in artillery can no longer trouble them as much as formerly, for their gallant defense has undoubtedly given sufficient time for the guns sent them by their western allies to reach the front. It would appear that another great German effort has failed to accomplish its ultimate object after starting out with overwhelming success. Such has been the history of practically all of their operations in the present war. Starting out brilliantly and rapidly moving to what appears to be an equally brilliant conclusion, they have been stopped each time just before they were in a position to attain the decisive results which seemed about to attend their efforts.

THE SOUTHEASTERN THEATER

Armenia

"The Armenian front became active according to the Petrograd statement of Dec 27. Near Lake Van Russian troops developed the first operation in some weeks in the capture of Altman, a village held by a Turkish guard. Near Charafkhan, west of the Mush, the Russians entered Turkish trenches, the report adds, while at another point they repulsed an attack on their own trenches, delivered by a Turkish battalion. As possible preliminaries of major operations the new activities in Armenia were noteworthy."

Macedonia

Since the capture of Monastir a month ago, the Serbians, French, and Italians have made efforts to follow up this victory. Villages in the neighborhood have been captured and slight advances made, but no considerable progress is reported. Unless Monastir can be made the starting point of a serious movement against Prilep and the main Bulgarian positions beyond (in particular, the line of the Vardar), its capture can have little effect on the military situation. It robs Bulgaria, however, of one of her main prizes of the war, and affords to King Peter a chance to return as monarch to a corner of his kingdom.

Noteworthy has been the co-operation in this region between Serbian, French, and Italian troops. The latters' support became a tangible asset when they developed an offensive at Tirnova, northwest of Monastir. The French and Serbians have been particularly active at Hill 1050, the possession of which has several times been sharply contested.

On Dec 18, this Allied offensive, which had been handicapped by fogs and rains, came to a halt. The appearance of new German troops is reported at several points, and it is believed "that Mackensen has begun sending forces down from the neighborhood of Bucharest to strengthen the Bulgarian lines for a possible later attack on Monastir and Salonika." (*Army and Navy Journal.*)

The Entente forces on the Vardar and the Struma have shown some degree of activity, but their effort seems to wait upon the result of the Monastir campaign and the perplexing altercation between the Entente allies and Greece. This quarrel assumed grave proportions on Dec 1, when fighting occurred in Athens. King Constantine had refused the demands of Admiral du Fournet, summoning Greece to surrender her army's artillery and much of its munitions. A force of Allied marines was landed at the Piraeus to enforce the demand. This led to an outburst of anti-Entente feeling, and the troops were later attacked upon the Acropolis by a mob of royalist sympathizers, but held their ground and inflicted considerable punishment. On Dec 8 the Allies instituted a blockade of Greek ports, and on the 15th the King agreed to the humiliating demands. It was promised that the royalist troops in Thessaly, whose position was such as to threaten the communications of the Monastir Allied army, should be withdrawn.

German efforts to stir up the Albanians against the Italian occupation of southern Albania appear to be bearing fruit, to judge from the report of an attack upon Italian troops by an Albanian band in Epirus.

January

A minor British offensive between the Vardar and Lake Doiran attracted some attention late in December. The Germans claimed its defeat, but the British reported the operation to be merely an extensive trench raid. There was little other activity during the month, except for some fighting near Lake Ochrida, in the Monastir region. Bulgarian reinforcements are reported to be arriving in this sector.

The Allies have recognized the rebel government of Venizelos. Their blockade of Greek ports has been maintained, despite the reported compliance of Constantine with their exacting demands. Whatever the legal aspects of the controversy, force, not law, now rules in Greece. However, interest in Grecian affairs and Sarrail's intentions has very largely diminished since the Central Powers overran Rumania. While only a single narrow line of communication existed uniting Germany with her eastern ally, there was a good chance of cutting it from one side or the other, but what chance now that there are a dozen? The purpose of this army was to join hands with the Rumanians; now that the latter are no longer a force, its main objective is gone.

February

Operations in Macedonia have been largely confined to artillery exchanges and patrol encounters. From the Monastir and Lake Doiran region come occasional reports of raids; these operations, however, have been hindered by snow-storms.

Altho the Greek King has been compelled to abandon his hostile attitude toward the Entente, the blockade has not been lifted, and the food shortage in Greece is now reported as being acute. Apparently the Allies have not yet obtained all the concessions that they regard as necessary for the security of Sarrail's force against the menace of a Greek royalist army at his rear.

March

The month has marked the resumption of a heavier offensive about Monastir. After five days' fighting, beginning Mar 13, the French reported the capture of several positions north of Monastir. Rashtani, a village occupied in this attack, is only three miles from Monastir, showing that no considerable advance has been made beyond that city. Hill 1248, also captured but subjected to sharp counter-attacks, provides for the French a good artillery position to command the rugged country farther north. Fighting continued during the remainder of the month north and west of the city; up to the 28th, the French claimed to have taken over 2100 prisoners in the course of the offensive. Their own loss, according to German reports, had been correspondingly heavy.

Italian troops have also been active during the month in the Cerna River bend, and farther west in Albania. Poroj, a railroad station on Lake Doiran, was taken by the British on Mar 18, but lost the next day. There has been some current talk of discontent among the Bulgarian troops, said to be due to short rations and sympathy with the Russian revolutionists.

April

The offensive north of Monastir, which won no notable advantages for the offensive, has not been renewed. Practically the only effort of the month was by the British, who penetrated the Bulgar line south of Lake Doiran to a depth of 500 yards, over a mile front. Subsequent counter-attacks were reported repulsed.

May

The operations that took place early in May on the Salonika front were hailed as initiating the beginning of a real offensive, at last, on Sarrail's part. All along the Monastir-Struma River line, there were advances and artillery engagements. The Serbs at Dobropoljes in the Cerna bend, and the British from Lake Doiran to the Struma River, took trenches and made progress.

Yet little has come of it all. It is apparent, rather, that the purpose of these operations has been to keep the hostile troops on this front occupied, to put additional burdens on the Bulgars, long weary of the war. The reported presence of Prussian Guard units on this front indicates that the movements to some extent achieved their purpose. During the latter part of May, the activity in this entire sector died down, and things became very quiet.

"It was significant that in the battle of May 5, Greek-Venizelist troops took part with the French for the first time in any important action. The French and Greeks, operating together, succeeded, according to Paris, in taking advanced positions from the Bulgars on a front of somewhat over three miles near Ljumnica."

June

The outstanding event in this region during the month is political rather than military in its nature, but the result may be so far reaching in its effects that it cannot be overlooked. On June 12 King Constantine of Greece abdicated in favor of his second son, Prince Alexander, in response to the

THE ITALIAN-AUSTRIAN WAR AREA
[The heavy fighting of the past month occurred on the Isonzo River and in the Julian Alps, from Tolmino (numbered 5 in the map) to near the Gulf of Trieste]

EUROPEAN WAR—Continued

demands of Great Britain, France and Russia. This action was taken by the Powers ostensibly in their capacity as guarantors of Greek independence under its constitution. The demand specifically eliminated Crown Prince George as Constantine's successor, as he is believed to hold strong pro-German sentiments. The eminent pro-Ally statesman and former Premier, M. Venizelos, has been recalled and has formed a new cabinet.

What effect this will have upon the military operations cannot yet be foretold. It is pointed out, however, "that General Sarrail at Salonika need no longer fear a stab in the back from Greece should he open a Balkan offensive, which some now look for." The Allies are generally believed to have about 650,000 men on the Balkan front.

Pending the secure establishment of the new Greek government under Entente auspices, French, British and Italian troops are occupying Athens and its seaport, the Pireaus. Allied forces have also been sent into Thessaly, probably to act as a temporary police for that province, which produces most of Greece's grain. The grain crop has not yet been cut, and its protection is doubtless the part of wisdom in view of the activity of German agents and several marauding bands of natives in that region.

Since the dying down of the Allied offensive undertaken at the time of the Italian Carso drive in an effort to divert reinforcements from that section, there has been no operation of any importance on the Macedonian front. The customary raiding operations have been undertaken by both sides, varied at times by lively artillery exchanges.

The British have abandoned a considerable strip of territory including thirteen villages, along the Struma, chiefly between lakes Tahimos and Butkova. The prevalence of malaria in the river bottoms during the summer season is given as the reason for this withdrawal.

July

Little activity has been shown in this region recently. The Greek army is being reorganized and strengthened concurrently with the firm establishment of the new government. It is planned to increase the army by ten divisions. These, together with the Greek troops who were called to the colors immediately upon the return of Venizelos to power, will form no mean addition to the Allied strength on the Macedonian front.

The Bulgarians attacked in some force and succeeded in making initial gains in the vicinity of Lake Doiran on July 5, but they were promptly ejected from the positions taken. Toward the latter part of the month a number of attacks were made against various

points along the Allied line, particularly on the section held by the Serbian troops. It is thought that these demonstrations are designed to affect the decision of the Allies to withdraw troops from Greece, their places to be taken by Greek organizations. The garrisons placed in Athens and a few other Greek cities about the time of former King Constantine's abdication are already being withdrawn, while the Italian troops now occupying Janina and other parts of Albania near the Greek border are to be removed shortly.

August

There were no developments of importance on this front during the month. Serbian troops made a few slight gains thru local attacks north of Monastir and in the bend of the Cerna river. A number of Bulgarian reconnoitering raids were reported, but these were apparently only for the purpose of ascertaining what the Allies were doing. One of these raids which was delivered against a part of the line held by Greek troops gave the first indication that Greece now had men in the advanced trenches.

September

Practically no activity was displayed on the Macedonian front during September. The few enterprises mentioned in the despatches were mostly on the part of the Allies. They appear to have been nothing more than reconnoitering raids, tho in one of them, early in the month, the French took two villages near Malik in the Monastir region.

A despatch from Rome on Sept 17, in which it was stated that the Italians were driving back the Bulgarians on the Voyusa River in Albania, called attention to this sector from which little has been heard recently. The Italians first occupied Albania in force about the end of 1915. They now have an army of some 500,000 men there, whose chief duty is to guard the military road which has been constructed from Avalona to Monastir, a distance of about one hundred and twenty-five miles. A considerable proportion of the supplies for Sarrail's army in Macedonia is now transported over this road, thus avoiding the submarine infested water route to Salonika.

October

Another month has passed with no pronounced activity on this front. Numerous raids have been reported but no attacks in force. In one of these raids British troops entered the village of Homondos near Seres on Oct 14 and captured 143 Bulgars. Berlin reported the repulse of a French attack near Lake Ochrida on Oct 20.

A French military mission has been organized under General Bracquet to take charge of the organization and training of the Greek army which is to be put into the field next spring. It has been stated that the addition to the Greek forces is to number 300,000 men.

Mesopotamia

"On the River Tigris, below Kut-el-Amara, the scene of Townshend's capitulation of last spring, a British force under General Maude has resumed the attack. London (Dec 15) reports that the British force on the Hai River, crossing from the left bank to the right, by a bold effort on Dec 13, took Kala Haji Fahan, two and one-half miles from Kut-el-Amara."

January

Occasional reports from this theater indicate some progress on the part of the British column just below Kut-el-Amara. London claimed on Jan 10 an advance of the line of trenches of 1000 yards northeast of the town, with the capture of 200 men. Conflicting reports, from British and Turkish sources, characterize the progress of this movement.

February

A vigorous effort is being pushed with the object of retaking Kut-El-Amara, the surrender of which to the Turks last April the British have felt very keenly. This movement, which commenced in December, has been supported by artillery much superior to that of the Turks, who are operating far from their base of supplies. The main advance has been made along the southern bank of the Tigris, where the English are reported to have built a narrow-gauge railroad to supply their army. The city itself lies in a deep bend of the river on the northern bank, opposite the point where the Hai River empties into the Tigris. In the operations from Jan 26 to Feb 1, the English forced the evacuation of line after line of Turkish entrenchments, until they had practically cleared the obstacles east of the Hai. According to Berlin, this advance cost the attackers 2000 in killed. Preceded by their cavalry, the British then crossed the Hai, and worked west until they commanded the next bend in the Tigris, the Shumran loop, thus threatening Kut from the west as well as from the south (where they held a large factory directly opposite the town).

At last, but not until Feb 17, the English turned their attention to the north bank of the stream, where the Turks still held the strong Sannaiyat position, 11 miles east of the town, which had blocked the relief column last April. Here they experienced a check. They at first succeeded in taking two lines of trenches, over a quarter-mile front. Turkish counter-attacks later in the same day, however, compelled the British to return to their original lines.

This check appears to be but temporary, however. The English continue to draw their lines closer about the town, in such a manner as to threaten to pen in the garrison.

March

The check that General Maude's force received at Sannaiyat, on Feb 27, proved to be only a temporary one. Five days later, the English penetrated and won a half-mile front of this formidable position. On the following day the westernmost column effected a decisive stroke. The river at this time was swollen from heavy rains, and presented a difficult obstacles, a quarter of a mile wide. The British boldly undertook the crossing, at a point opposite Shumran, and partly swimming, partly ferrying by means of pontons, they gained the opposite bank. A ponton bridge was then constructed after nine hours' work by the engineers. The town was now in a critical position, surrounded on three sides. Evacuating Kut on Feb 24, the Turks, whose main line of communication was already cut, hastily retreated along the Bedrai caravan route to the north.

General Maude lost no time in following up his victory and pressing the retreating Turks, whose flight became more and more disorganized. Accompanied by

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his river boats, he was able to make rapid progress along the caravan route toward Bagdad. By the end of February he had passed thru Azizie, half-way to that city, where a rear-guard engagement was fought. Finally, on Mar 7, the British cavalry encountered the Turks at the mouth of the Dialah, a few miles below Bagdad. (They had deserted a prepared position farther down stream at Ctesiphon, which marked the limit of Townshend's previous advance.) The British infantry came up on the 8th, crossed the Tigris by a ponton bridge (the third crossing in two weeks) and engaged the Turks on the Dialah line. After three days of fighting, which included a night attack and culminated in a blinding dust storm, the British took the last positions before Bagdad. On the morning of the 11th they entered the dismantled city, capturing many pieces of artillery but few prisoners. This victory, culminating an advance of over a hundred miles, followed only two weeks after the capture of Kut-el-Amara. Since December, 1916, it is estimated that the Turks have lost 20,000 in killed and wounded, besides 7000 prisoners.

The *Army and Navy Journal* finds this campaign of special interest to U. S. Army officers, "since the conditions under which the Anglo-British troops have been fighting their way up the Tigris River more nearly approximate campaign conditions in America than those along any of the other fronts. The combination of land engagements with the gunboats aiding from the river carries us back to Civil War conditions; and there have been constant cavalry engagements such as are practically unknown in the western theater. . . . The first campaign was begun without a proper appreciation of the difficulties involved. There were underestimates of the number of troops needed, the supplies and munitions required, the transport problem, and the size and equipment of the medical department. But when General Maude was put in command of the army based on Basra he was given a modern force, equipped with airplanes, proper transport, and a fleet of river gunboats under skilled commanders." Gen. Maude's force is estimated to have been not less than 120,000 men.

Since the fall of Bagdad, the pursuit of the Turks has been continued not only up the Tigris, but across into the Euphrates Valley toward Hit, and up the Dialah River, where the main Turkish force seems to have retired. British troops, by the end of March, had progressed about fifty miles beyond Bagdad, and the Turks in this area had shown no signs of a rally sufficient to threaten Gen. Maude's position. An un-

official report states that Mackensen has been sent to Constantinople to take general control of the Turkish forces.

The Russians, like the British, have recovered their lost ground, and their approach to Bagdad and Mosul from the east, co-operating with the British advance, constitutes a serious threat to the Turks. Hamadan was reoccupied by the Russians on Mar 2; Kermanshah was reached on Mar 12, after a two-days' engagement. At the end of March, this force was close to Khanikin, squarely in the pass that leads down into Mesopotamia and less than a hundred miles from Bagdad. The Turks retreating up the Dialah were thus threatened both from front and rear. Moreover, other Russian troops, operating farther north from Sakkiz and Bidjar, had crossed the boundary into the province of Mosul. Still farther away, in the neighborhood of Lake Van, Russian advances were likewise reported; the British success had encouraged their allies to renewed activity all along the line.

April

A month ago, the Turks were retreating up the Diala River from Bagdad. The approach of the Russian column from Persia toward their rear raised the hope that the Turks might be cut off and surrounded. The juncture ot British and Russian advance troops was actually made at Khanikin on Apr 5. But the Russian support in the further operations has been of little value, apparently. The Turks in this vicinity made good their retreat, one body retiring toward Kifri, others taking refuge in the rugged Jebelttamrin hills. General Maude, with little evidence of assistance on the part of the Russians, has continued with his main body up the Tigris, fighting an occasional action with the retreating Turks. One stand was made on the Shatt-el-Adham River. Another Turkish force, attempting to defend Istabulat, lost over 1200 prisoners. Finally, on Apr 22, the Turks stood, six miles in front of Samarra, on the strongest line they had held since leaving Bagdad. They were driven out by a night attack, however, and evacuated Samarra the next day. With this town, the northern terminus of the isolated end of the Bagdad railroad, the British took 16 locomotives, over 200 trucks, and other rolling stock. Samarra is about 75 miles up the Tigris from Bagdad.

May

Since the capture of Samarra, Gen. Maude's force has made little, if any, progress up the Tigris. With this town, the probable northern terminus of the isolated end of the Bagdad railroad, the British took 16 locomotives, over 200 trucks, and other rolling stock. The weather is becoming unfavorable, and the project of a summer campaign beyond the rail-head, if contemplated, presents problems which explain any present inactivity.

Russian co-operation has proved a disappointment. One force, fighting its way across the upper Diala on May 10 in a tardy attempt to strike the Turkish flank-rear, was forced back across the river four days later. A Turkish force, of something like 20,000, has been driven by the British into the Jebel Hamrin Hills.

Not only have the Russians failed to render help to the British; they have given ground to the Turks in Armenia. The city of Mush, forty miles west of Lake Van, has been an important outpost of their Asiatic front, affording as it does a favorable starting-point for an expedition against the upper Tigris seventy-five miles to the south. On May 2, their abandonment of this position was announced by the Turks. This retirement, which does not appear to have been a military necessity, is one of numerous bits of testimony to the unsettled and disorganized conditions of the Russian armies.

June

On June 21, Turkish forces attacked the right wing of the British on the Diala River and succeeded in recapturing Sheraban. The Turks also report the repulse of small Russian attacks at points along the Persian and Caucasus fronts. Otherwise this region has been devoid of military events.

It seems not too much to suppose that the British campaign against the Turks is, for the time being at least, at an end. Both Mesopotamia and Palestine lie in an area unsuitable for campaigning during the summer months. In any event the primary object of their operations—the protection of the oil fields at the head of the Persian Gulf—has been accomplished. The first ill-fated expedition up the Tigris, pushing farther than was contemplated by their instructions and poorly equipped for such an enterprise, met with such serious reverses that it seemed the part of policy for the British to endeavor to wipe out the memory of their defeat. This they have now handsomely accomplished. In addition they hold securely practically the entire Mesopotamia plain, the garden spot of the ancient world, and one of the objects kept in view by the Germans in the Berlin to Bagdad railway.

July

Following their minor successes in repulsing Russian attacks on the Persian border in the latter part of June, the Turks launched a strong offensive during the first days of July against the left wing of the Russian forces at the point of junction with the British. The effort met with complete success. The Russians were driven from Khanikin and forced to fall back well across the Persian frontier. A wide breach was opened up between the Russian troops and their British allies.

The British, aside from sending a small force southwestward from Bagdad to the Euphrates, were inactive on this front thruout the month.

August

Since the successful July offensive of the Turks in which they drove the Russians back from their juncture with the British, they have from time to time, by means of minor attacks, endeavored to press the Russians still farther away from their allies. One of the most successful of these attempts occurred near Mosul, Persia, the latter part of August, when the Russians were forced back upon Baneh. The British pushed a column from Bagdad toward the Persian frontier to hinder the Turks in their attack and to aid the Russians should they feel able to attempt once more a

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junction with their Allies. The Russians on the Caucasus front made several spasmodic and disconnected local attacks, none of which accomplished anything. Apart from these purely minor operations there was no activity in any part of the Turkish theater.

September

The outstanding event of the month in the Turkish theater was the capture, by the British, of the town of Ramadie on the Euphrates. The Turks had for some time been concentrating troops and supplies at Ramadie. This concentration seemed to be for the purpose of advancing against the communications of the British forces about Bagdad. As the hot weather was drawing to an end and the threat might be expected to be put into execution at an early date, General Maude decided to anticipate the designs of the enemy by himself attacking. After careful preparation, a rapid night march on Sept 27 put the British in position to attack Ramadie from the east at daylight the next morning. While this attack was progressing favorably, a force of infantry worked around to the Turks' right flank, the cavalry meanwhile making a wide detour and coming in from the west.

The Turks now found themselves entirely hemmed in against the river. After several heroic attempts to cut their way thru the encircling lines, particularly toward the west, where the British cavalry blocked the road to Aleppo, the Turkish forces surrendered on Sept 29. Large quantities of material and several thousand prisoners, including the Turkish commander, Ahmed Bey, were captured. In addition to the immediate advantages of the victory, the British occupation of Ramadie makes secure the western flank of the forces on the Tigris.

November

The British forces in Mesopotamia sent a raiding column up the Tigris in the first days of November. Early on the morning of the 1st their advance troops drove a Turkish detachment from a position on the right bank of the Tigris opposite Due, about twenty miles north of Samara. The Turks fell back to the north, leaving a strong rear guard which attempted to delay the British advance but was rapidly driven from its successive positions. Following up the retreating Turks, the British found a strong force entrenched south of Tekrit. The works were attacked on the morning of the 5th. After a stubborn battle lasting thruout the day, the Turks finally retreated at nightfall. The British occupied Tekrit on the 6th. With the town they captured large quantities of stores, Tekrit having been an important Turkish base. It is stated that the bulk of these supplies had been collected by Falkenhayn for the offensive which he is rumored to be about to start for the recovery of Bagdad. The capture of this point marks the greatest British penetration into Turkey. Tekrit being ninety-seven miles up the Tigris from Bagdad. It was later reported that the raiding force had destroyed the Turkish stores and had withdrawn to their former lines without further encounters with the enemy.

The British suffered a severe loss on Nov 18 in the death of General Maude, the commander of the Mesopotamian expedition. General Maude was recognized by military men the world over as a leader of no mean ability. After a distinguished career, he first came into the public eye in the present war thru his skilful evacuation of the lines at Suvla Bay on the Gallipoli peninsula. Placed in charge of this movement, he carried it out without a single casualty. He was put in command of the Mesopotamian expedition in August, 1916, after the series of British reverses culminating in the surrender of Kut-el-Amara. His successes since that time are too well known to require mention.

Palestine

March

"On the borderland between the Sinai Peninsula and Palestine, a British force, London (Dec 22) reports, took the Turkish post of El-Arish, strongly intrenched after a stout resistance. A thousand prisoners, two guns and other material were captured a few days later, according to a subsequent report, when the British force overtook the Turks at Maghadah, twenty miles to the southeast."

The Holy Land became a new theater of warfare when, early in March, a British force advancing from the Suez region crossed the boundary of Palestine. In order to munition their army and to solve the troublesome question of water supply which had baffled the Turks earlier in this region, the British are now building a railroad line along the coast as they advance. The expedition consists largely of Australian and New Zealand troops, with some English regiments and a contingent of Indians. Automobiles and camels supplement the transportation facilities. Capturing the ancient city of Beersheba (the opposite extreme from Dan), the column next advanced to El Khalil, the ancient Hebron, where the Turks evacuated an extensive series of earthworks. Approaching Gaza on the coast, on Mar 26 and 27, an engagement was fought with 20,000 Turks, which cost the latter 8000 men in killed and wounded (according to Bonar Law's announcement in Parliament), with a loss of only 400 to the British. A division commander and staff were captured in an attack by mounted troops and armored motor cars, and only the water shortage, it was said, prevented a more complete victory. The invading column is now not far distant from Jerusalem.

April

In spite of the initial success in front of Gaza, further British progress against that seaport has been slow. A British attack north of the Madi Ghuzze River on Apr 16 carried the Turkish advanced positions over a six-mile front, an operation that was assisted by fire from British warships. On Apr 22, the main positions were reported to have been reached. Later reports have referred chiefly to the bombardments of the defenses.

The report quoted last month that the British had reached Hebron, near Jerusalem, appears to have been a mistake caused by a confusion of names. The in-

vasion is being directed along the sea-shore, and Jerusalem, which has strong natural defenses, has not been approached.

July

The Turkish trenches on the Gaza front have been subjected to heavy artillery fire, but there have been no infantry actions except trench raids. On July 19 the British cavalry fought an engagement with two regiments of Turkish cavalry west of Beersheba, driving them back into that city.

October

The British Palestine expedition captured Beersheba on Oct 31. General Allenby's tactics were very similar to those employed by the Mesopotamian force last month in the capture of Ramadie. After a night march the infantry attacked in the early morning from the west and southwest, while mounted troops made a wide turning movement and came in, from the east. The Turks made a determined resistance but the city was finally occupied in the evening. Eighteen hundred prisoners and nine guns were captured with the city.

This is the first considerable activity in this section for some months. The British-Egyptian army entered Palestine last spring under the command of Sir Archibald Murray. The advanced troops penetrated to within twenty miles of Jerusalem, but were withdrawn upon the near approach of hot weather before the main force could reach the advanced position. The expedition spent the summer in front of the Turkish entrenchments at Gaza. In August General Murray was succeeded in the command by General Allenby, who was in command of the cavalry division at Mons in 1914. The sudden blow against Beersheba seems to indicate an intention to resume active operations on this front with the return of cool weather. Beersheba is some twenty-five miles southeast of Gaza and forty miles south of Jerusalem. It is located on the railroad which parallels the coast and runs north thru Jerusalem.

November

The British offensive in Palestine, which was presaged by the capture of Beersheba on Oct 31, has developed into an extensive movement. On the night of November 1 the defenses of Gaza were attacked from the west and southwest. The Turks were driven from their first line trenches on a front of 5000 yards. The pressure was continued and Gaza was captured on Nov 6, the British pressing on thru the town to the Wadi Hesi, eight miles north of their original positions. In the meantime the forces which had taken Beersheba were working to the north and northwest of that city. When Gaza fell these troops to the east were nearly on the line of the main army. The Turks now began a hasty retreat along the whole front from the Mediterranean to the Dead Sea. Their first stop was along the northern branch of the Wadi Sukereir, where they took up a position stretching to the southeast to cover Hebron and Beit Jibrin.

This line was forced on Nov 13 and the movement continued. By this time General Allenby had established a continuous front from the coast to the Dead Sea. The forces in the interior were, however, comparatively weak and did not advance as rapidly as the main body working northward along the coast. Australian and New Zealand mounted troops occupied Jaffa on the 17th without opposition. This city is the port of Jerusalem, with which it is connected by a good road thirty-one miles in length and a railroad fifty-four miles long, running by way of Ramleh.

On the 19th the British carried Kuryet-el-Enad, six miles west of Jerusalem, and Beit Likia, five miles northwest of the city. These gains put the British well to the north of the Jaffa-Jerusalem railroad and threatened the Turkish retreat northward from the city. Within the next few days Bitur, six miles southwest of Jerusalem, was occupied, while the forces directly to the west pushed forward to Ain Karun, three and a half miles from the city. Strong bodies of Turks were found holding the high ground west of Jerusalem and covering the main road to the north.

AFRICAN THEATER

German East Africa

June

"In German East Africa the British have opened a new attack from the coast against the German and native forces defending this last remaining of the Teuton's colonial possessions." On June 10 British colored troops from India landed at the mouth of the Lukeledi River, under the protection of naval guns, and occupied the town of Neweka. As a result of last year's operations, the Germans are now confined to the southern part of the colony. Their present retreat from the coast is limited on the south by garrisoned Portuguese territory and on the west by Lake Nyassa.

July

The Indian troops which landed at the mouth of the Lukeledi river in German East Africa in June have started an advance up that stream. In conjunction with two other columns advancing from the parts of the colony already in British hands, they are closing in on the small body of German and native troops who are holding this last remaining corner of the Kaiser's colonial dominions.

September

The difficult campaign against the last remaining defenders of German East Africa is slowly meeting with success. The German forces have been entirely driven from the Portuguese territory south of the Rovuona River, which they had occupied since early in the war. Following up their successes, the British and Portuguese troops drove the Germans from Mponda, on the Rovuona, on Sept 8. Only a small portion of the southwestern corner of the German possession now remains in their hands.

October

The British campaign for the final expulsion of the Germans from Africa is proceeding satisfactorily. On Oct 11 the right column, moving southward from the Mbemkuru Valley, occupied Rupondo. The Lukelidi Mission was taken five days later. The main body of the Germans retreated from the

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Mbemkuru Valley to Mahiwa, four miles southwest of Nyangao. On Oct 15 they were driven on to Nyangao, which was taken by an enveloping movement on the 17th. The fighting was proceeding at last accounts.

The German detachment which was driven from Mponda last month was brought to bay and severly handled at Klingoli in the Luwego Valley, forty-three miles southeast of Mahenge.

November

General Vandeventer, commander of the British forces in East Africa, has reported that reconnaissances have established definitely that German East Africa is completely cleared of the enemy. Only a small German force now remains in being. This has taken refuge in adjoining Portuguese territory, and measures are being taken to deal with it.

With the loss of German East Africa the German Empire is deprived of the last, largest and most valuable of its former overseas possessions. Its 384,000 square miles of area made up more than one-third of the total extent of the German pre-war foreign possessions. It contained three-fifths of the white and over half the black population of the German colonies. Its potential wealth is estimated in billions.

NAVAL OPERATIONS

April

The first American armed merchant steamer to be destroyed by a German submarine was the *Aztec*, of 3727 tons. She was torpedoed without warning in the British Channel on the night of Apr 2, 1917, during a heavy sea, off the island of Ushant. Owing to the darkness of night the U. S. Navy gun crew on board the *Aztec*, had no chance to spot the submarine and use either of the two 5-inch guns she had aboard. Twenty-seven of the crew were lost, in addition to Boatswains' Mate Epolucci, of the gun crew.

The sinking of the Norwegian steamer *Camilla* by a German submarine on Apr 7 without warning, made the seventh Belgian relief ship torpedoed. All these ships bore safe-conduct passes, and were sunk in broad daylight outside the war zone on a line guaranteed by the German government as safe.

The volunteer patrol boat *Lily II* made the first capture in her class since the war was declared by the United States against Germany. She captured the yacht *Sparrowhawk*, in command of Ernest Bethge, one of the crew of the German steamship *Cincinnati*, as she was leaving Boston harbor on Apr 7.

The loss of the British hospital ship *Salta*, sunk by a mine on Apr 10, brings the total number of hospital ships lost during the war to eight.

"Two German torpedo boat destroyers, if not three, were sunk, near Dover, England, on the night of Apr 20, by British patrol boats, with no material damage to the British boats, according to the Admiralty report. The German official statement describing the action off Dover says that a British outpost vessel was destroyed, that a British scouting vessel was sunk by a torpedo and that several others were heavily damaged, and one probably sunk."

Other German destroyers have been active in raids and bombardments off the French and English coasts on several occasions during the month.

The first shot fired in the war by the armed forces of the United States was aimed at a German submarine, which the American freight steamer *Mongolia* encountered in British waters on Apr 19. It was a splendid shot, made at 1000 yards. Captain Rice of the *Mongolia* declared in a statement to the press that the periscope of the submarine was seen to be shattered by the shot.

"I can't speak too highly of the cool manner in which the lieutenant handled his crew of gunners," said Captain Rice as reported by the Associated Press, in a cable from London. "It was a fine exhibition of the efficiency of American naval men."

The gun-crew of the *Mongolia* was commanded by Lieut. Bruce R. Ware, Jr.

By the sinking of the American oil tank steamer *Vacuum*, by a German submarine on Apr 28, five members of the U. S. Navy gun crew were lost, the other eight being saved. Fifteen members of the crew of the *Vacuum* also lost their lives. The gun-crew, which was commanded by Lieut. C. C. Thomas, U. S. N., had virtually no chance to fire a shot.

May

"A battle unique in the history of the world took place in the Strait of Otranto, between Italy and Albania, on May 15. Five nations participated in it and the fighting was carried on in the air, on the sea and under water simultaneously. A squadron of Austrian and German cruisers and destroyers made a night attack upon the chain of Italian, British and French patrol vessels blocking the Strait. Fourteen British drifters and several Italian vessels were sunk, yielding 72 prisoners. British and Italian cruisers hurried to the spot and pursued the enemy all the way back to Cattaro. The British cruiser *Dartmouth* kept in contact with three enemy ships for more than two hours at high speed firing about 600 shots, but was struck by a torpedo from a U-boat and lost several men. The Italian seaplanes hovered over the enemy vessels in their flight, dropping bombs."

The losses to the British transport service during May have been unusually heavy. No less than three large transports have been torpedoed in the Mediterranean, the *Transylvania, Arcadia and Cameronia,* with an aggregate tonnage of 34,000 tons, and a total loss among the troops of 800 officers and men. Several hospital ships have also been sunk during the month.

The following notes of naval interest are from the *Army and Navy Journal:*

"It is interesting to note that even a convoy of fast torpedoboat destroyers does not render a troop transport immune from submarine attack. An announcement issued by the British Admiralty on May 26 in giving some additional facts concerning the torpedoing of the British transport *Transylvania* in the Mediterranean on May 4 by a submarine, says that at the

time she was being escorted by Japanese destroyers. The destroyers engaged the submarine. According to the announcement, the Japanese rescued 2800 out of 3000 troops on the *Transylvania*, winning the praises of Japan's allies by their bravery."

"An apparently successful attempt by British warships and airplanes to bombard the German base at Zeebrugge was made on the morning of May 12. The British Admiralty in telling briefly of the attack state that over fifteen aerial combats occurred in which four enemy machines were destroyed and five others were driven down out of control. Two British machines failed to return. According to unofficial reports received at Rotterdam, Holland, the attack made at Zeebrugge was the most destructive yet carried out by British warships. Two submarine sheds were blown up, it is stated. Sixty-three persons were killed and upward of 100 others were taken to hospital."

"British naval forces destroyed Zeppelin *L-22* in the North Sea on May 14, according to an official statement issued by the Admiralty. The Zeppelin was attacked by a battle plane which overhauled it, and was seen to burst into flames. The destruction of the *L-22* marks the fourth attempt at Zeppelin raids within the last year which has ended in disaster."

"According to an interview with a sailor of the German submarine *U-58*, published recently in the *Telegraaf*, of Amsterdam, Holland, the Germans have about 325 submarines in operation, and about 100 have been lost thru British nets alone. When at sea the submarines assemble at a given point every morning and receive wireless instructions. There are about thirty-nine U-boats of the newest type, each carrying a crew of fifty-six men, and this fleet is supplemented by a secondary squadron marked with a C. The first-class boats have a speed calculated as sufficient to overtake any cargo boat. Two-thirds of their crews are experienced and one-third novices. The boats carry a fortnight's stores and have a maximum period of submergence of from eight to ten hours. Each is equipped with two periscopes and sometimes descends to from thirty to fifty meters."

"It seems very certain that the marked decrease in the effectiveness of German submarine warfare in British waters shown recently is due to the help afforded by the United States destroyer flotilla now helping in the patrol work. The addition of the United States flotilla permits a greater area of seas to be policed and lessens, accordingly, the opportunities of the submarines to carry on their destructive work. The Associated Press correspondent at London reports an official of the British Admiralty as saying: 'The American destroyers are playing no small part in the anti-submarine war, and our officers have expressed the greatest enthusiasm at the spirit, enterprise, acumen and quick wittedness with which the American unit has taken up its work. The Americans are already thoroly conversant with our methods, and we hope that they soon will begin teaching us some new angles.'"

"For the third week in succession the losses of British shipping from the submarine war have been held substantially below the large figures which caused so much alarm last month. The losses reported last week were considerably less than half those of the preceding week, as regards the number of vessels sunk, and the report given out on May 23 shows only a small increase over last week. The destruction of eighteen vessels of more than 1600 tons, five less than 1600 tons and three fishing vessels was shown in last week's statement. The heaviest losses were shown in the report of Apr 26 last, which announced the sinking of forty vessels of more than 1600 tons each. French losses for the three months of Germany's unrestricted submarine campaign, according to the Paris official report, show a total of 17 boats sunk, and 9 unsuccessfully attacked."

June

To Americans, the most important naval occurrence of the month is the repulse of submarine attacks on the transports conveying our first military expedition to France. Secretary Daniel's statement in the matter is, in part, as follows:

"The transports bearing our troops were twice attacked by German submarines on the way across. On both occasions the U-boats were beaten off with every appearance of loss. One was certainly sunk, and there is reason to believe that the accurate fire of our gunners sent others to the bottom.

"For purposes of convenience the expedition was divided into contingents, each contingent including troop ships and a naval escort. . . . An ocean rendezvous had also been arranged with the American destroyers now operating in European waters in order that the passage of the danger zone might be attended by every possible protection.

"The first attack took place at 10:30 on the night of June 22. . . . Our ships were set upon at a point well this side of the rendezvous and in that part of the Atlantic presumably free from submarines.

"The attack was made in force, altho the night made impossible any exact count of the U-boats gathered for what they deemed a slaughter. The high seas convoy, circling with their searchlights answered with heavy gunfire, and its accuracy stands proved by the fact that the torpedo discharge became increasingly scattered and inaccurate. It is not known how many torpedoes were launched, but five were counted as they sped by bow and stern.

"A second attack was launched a few days later against another contingent. The point of assault was beyond the rendezvous, and our destroyers were sailing as a screen between the transports and all harm. The results of the battle were in favor of American gunnery. Not alone did the destroyers hold the U-boats at a safe distance, but their speed also resulted in the sinking of one submarine at least."

It is believed that the German Admiralty took extraordinary measures to sink the American transports. The recent lull in submarine warfare was probably caused by the U-boats refitting preparatory to a supreme effort to sink a large number of

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troops in the first American expedition, for the moral effect of such an occurrence.

The number of merchant vessels sunk by submarines during June showed a slight increase over the average for the weeks immediately preceding, but still well below the rate established in March and April. The greater number of vessels and improved methods of the Allied naval patrol have been successful in keeping the losses due to submarines within at least partial control.

An unofficial cable from Rome on June 2 announced that the French submarine *Circe* had sunk a large Austrian submarine at the entrance to the harbor of Cattaro.

On the night of June 3 an Austrian torpedo boat was sunk by a submarine in the northern Adriatic.

In a long range engagement on June 5 between six German destroyers and a squadron of British light cruisers and destroyers, one German vessel was sunk and another seriously damaged.

The Japanese destroyer *Sakaki* was damaged, with a loss of fifty-five men, in an engagement with a submarine in the Mediterranean on June 11. The next day a Japanese flotilla attacked a submarine and probably sank it.

The armed British merchant cruiser *Avenger* was torpedoed and sunk in the North Sea on the 13th.

During the month the British naval and air services destroyed two Zeppelins, the *L-43* on June 14 over the North Sea and the *Z-48* two days later during a night attack on England.

The United States Navy has taken over the patrol of the South Atlantic, the patrolling force being joined toward the end of the month by the Brazilian naval forces, closely following the latter nation's abrogation of her decree of neutrality.

July

The Allied policy of arming merchant vessels is being further justified every day. In addition to a number of instances where a vessel's armament has saved it from destruction, the news reports during July have recorded the sinking of several submarines by the fire of guns mounted on merchantmen.

A British destroyer was torpedoed by an enemy submarine and sunk in the North Sea on July 6. The next day a German torpedo boat was destroyed by striking a mine.

The British battle-ship *Vanguard* was destroyed by internal explosion while at anchor on the night of July 9. Of those on board at the time only one officer and two men survived, the officer having since died of injuries. Twenty-four officers and seventy-one men were ashore at the time of the explosion.

On the 16th six German merchant vessels, which were trying to escape from Rotterdam to Germany, were overtaken by British destroyers. In an attempt to get back to Dutch territorial waters, two were successful, tho badly damaged by gunfire. The other four were intercepted, captured, and taken to England as prizes. The German steam-ship *Batavia II* was captured in the North Sea on July 27 by a British submarine. The vessel was so badly damaged by gunfire that she could not be taken to port.

An unusual occurrence—the capture of a submarine by a troop of cavalry—took place on July 26, when a German submarine stranded on the coast of France west of Calais. When the crew found themselves unable to float their craft, they opened the gasoline tanks and set it afire. A troop of Belgian cavalry, exercising on the beach, put out the fire, captured the crew and took possession of the submarine, which was not seriously injured.

The British Admiralty announced, on July 30, that the cruiser *Ariadne* had been torpedoed and sunk by a German submarine. Thirty-eight of the crew were killed by the explosion, the remainder being saved.

British naval airplanes successfully bombed the enemy fleet in the Golden Horn, off Constantinople, on the night of July 9. Hits were obtained on the battle-ship *Goeben* and on other warships. Heavy explosions and fires were observed. The airplanes all returned in safety.

August

The news of the month of August has been particularly meager in events of naval interest. Only one engagement, and that of a very minor character, took place. On Aug 16 there was a long range fight between a force of British patrol boats and a German destroyer with two mine sweepers. The Germans quickly took cover behind their mine fields where they could not be followed. Both sides state that no damage was inflicted.

The British Admiralty announced on Aug 14 that one of their destroyers had been sunk by a mine in the North Sea. Most of the crew were rescued. On the 17th the Russian destroyer *Lieutenant Bourakoff* was sunk by a mine near the Aland islands in the Baltic.

British naval vessels destroyed a Zeppelin on Aug 21 off the coast of Jutland. There were no survivors from the crew of the airship.

The merchant tonnage sunk by submarines during August was practically the same as in July, when the number of vessels lost was smaller than in any previous month since the beginning of the submarine campaign. It has been recently stated in Washington that thru the close co-operation of the British and American patrolling forces and the adoption of new protective measures, less than one-half of one per cent of the vessels so protected in their passage thru the danger zone have been torpedoed. In this connection it is interesting to note that the German Emperor, thru the good offices of the Spanish government, has definitely accepted conditions under which hospital ships are to be no longer subject to attack by submarines. Under the arrangement a Spanish officer, acting as a neutral commissioner, is to be carried on each hospital ship to guarantee that the vessel is used for the transportation of sick and wounded only.

What is claimed to be a new device in naval warfare was first used in the Adriatic by the Italians toward the end of August. It appears to be a new type of monitor or floating battery, tho details are

withheld. The despatch mentioning the new craft indicates that the Italians have at least three of them and goes on to say: "The Italian navy has surpassed in caliber and range every previous record by mounting on special floats, whose construction and detail are a profound secret, artillery of a power exceeding any armament on any Austrian dreadnought. The Italian navy has devised and inaugurated a new system of naval warfare." These powerful new instruments have assisted the land batteries in shelling the enemy trenches near the coast, and have also bombarded at long range Trieste and the Austrian naval base at Pola.

The Japanese Embassy in London announced on Aug 11 that additional Japanese naval units had joined the Allied fleets in European waters. A force of Japanese destroyers has been assisting in the protection of shipping in the Mediterranean since about the time that the American destroyers joined in the patrol in northern waters.

September

Fewer merchant vessels were sunk by submarines during September than in any former month since the intensified campaign began. The decrease has been progressive for several weeks. For the last three months the figures have been distinctly more encouraging than previously, and the fact that the decreased rate has been maintained so consistently, with a steady lessening of the number of sinkings, seems to prove that the Allied patrol is gradually solving the problem of coping with this new method of warfare.

Four German mine-sweepers were destroyed by the British partol off the coast of Jutland on Sept 1. About one hundred German seamen were saved.

A German submarine shelled the summer resort of Scarborough, England, for ten minutes on the night of Sept 4. Three persons were killed and five injured, little material damage being done. The submarine was driven off by British mine sweepers. A seriously damaged German submarine was convoyed into Cadiz, Spain, by a Spanish torpedo boat on Sept 10. The submarine was interned for the war.

The Italian converted cruiser, *Umberto I*, was sunk recently in the Mediterranean by striking a mine. On Sept 9, Italian airplanes bombed the Austrian naval base at Pola, sinking one submarine and a vessel loaded with supplies.

Copenhagen announced on Sept 19, that two German submarines had been sunk by British warships. It was stated on the same day, in a despatch from Christiania, that a third submarine had been sunk in the North Sea by an armed American steamer.

An announcement by the Admiralty, made on Sept 22, stated that a destroyer had been sunk by a German submarine near the entrance to the channel. Fifty members of the crew were saved. It was further announced that British warships had satisfactorily bombarded the German works at Osfend. Three enemy seaplanes were shot down while attempting to observe for the land batteries.

The Russian destroyer *Ochotnik* was sunk by a mine on Sept 26 off the island of Oesel in the Baltic.

October

On Oct 6 Secretary Daniels gave out a statement concerning a recent fight between an American destroyer and a U-boat. The action lasted twenty-two minutes and it was believed that the submarine was finally destroyed. An American destroyer was torpedoed by a submarine on Oct 16 with a loss of one man killed and five wounded. The damaged vessel managed to reach port.

The first American transport to be sunk was torpedoed on Oct 17 while on a return trip from France under naval convoy. Neither the torpedo nor the submarine which fired it were seen. Of the 237 persons aboard the *Antilles*, seventy were lost, including sixteen soldiers and four members of the naval gun crew.

The British armored cruiser *Drake* was torpedoed off the north coast of Ireland on Oct 2. One officer and eighteen men were killed by the explosion. The cruiser reached a safe harbor but then sank in shallow water.

Early on the morning of Oct 7 the German submarine which was interned at Cadiz last month made its escape to sea. It had no guns, ammunition, or torpedoes on board, everything of that kind having been removed upon its internment. The officers and men of the vessel had given their parole not to escape and were allowed full liberty in Cadiz. All the responsible Spanish authorities, including the head of the naval district and the general commanding the arsenal, were at once relieved from their commands.

Rome announced on Oct 11 that an Austrian destroyer had been captured by the Italians in the Adriatic. The Austrians surrendered without firing a shot.

It was announced in a dispatch on Oct 10 that about six weeks previously there had been a mutiny among the crews of four German battleships at Wilhelmshaven. The captain of one of the ships was thrown overboard and drowned. The mutineers went ashore. It was necessary to use soldiers to round up the disaffected sailors, as the marines who were first sent after them refused to fire upon them. A mutiny aboard the warship *Nurnberg* while at sea was also reported. In this case the crew tried to take the vessel to Norway but were intercepted and turned back by destroyers. Emperor William ordered that one out of every seven of the mutineers should be shot. Chancellor Michaelis protested against this decree so only three of the ringleaders were shot, the others getting heavy prison sentences. The Minister of Marine announced in the Reichstag that a plot had been discovered to organize in the fleet a council of delegates on the Russian model with the idea of paralyzing the navy and forcing the government to make peace.

The *New York Times*, in a copyrighted dispatch from a foreign correspondent, states that the trouble in the German fleet is believed to have been caused by the practice of drafting men from the navy to

EUROPEAN WAR—Continued

man the submarines. In the beginning there was no lack of volunteers for this service. As time went on, however, and the losses became greater (being estimated as high as fifty per cent) the number of volunteers became too few and it was necessary to force men to serve on the undersea craft. This has brought about a growing disaffection among the sailors, which may well have come to the surface in an outbreak of this kind. On Oct 18 a mutiny at Ostend was reported, as well as similar occurrences at Pola and Fiume in the Austrian fleet.

The German operations for the capture of the islands at the mouth of the Gulf of Riga were supported by a large fleet of naval vessels and were accompanied by more naval actions than have been seen for months. The German fleet was reported to include eight dreadnoughts, a dozen light cruisers, forty destroyers and thirty mine-sweepers. The German landings were covered by the fire of the warships. The Russians reported that in an action between several vessels and a shore battery on Dagoe Island four torpedo boats were sunk and a cruiser ran aground; the battery was destroyed by the fire of the fleet.

On Oct 14 a part of the German fleet tried to force a passage thru Irbe Channel but was repulsed by the shore batteries. At the same time twelve destroyers, supported by a battleship, entered Soela Sound, between Oesel and Dagoe Islands. They were engaged by the Russian flotilla and were driven back after a brisk engagement. Two German destroyers were sunk and two more severely damaged, while the Russians lost one.

On the 17th, as soon as the fortifications on Oesel Island had been reduced, the German fleet entered the Gulf of Riga and engaged the Russian squadron. Overwhelmingly outnumbered and confronted by guns of much greater range and power than any they possessed, the Russians were soon driven back in spite of a valiant resistance. They retreated northward into Mohn Sound. The battleship *Slava*, which had been so severely injured in the action that it could not keep up, was sunk in the channel between the gulf and the sound in an effort to prevent the Germans from following. The German destroyers got thru, however, and two of them were sunk the next day by striking mines. The Russian squadron escaped to the north into the Gulf of Finland.

November

On the morning of Nov 2 a German auxiliary cruiser and ten patrol boats were sunk by British destroyers in the Cattegat. The interesting feature of this action is that the destroyers, armed with only four-inch guns, were able to defeat and sink the cruiser which had six-inch armament. A week before two similarly armed German cruisers had sunk two British destroyers and several of the merchant vessels they were convoying. By the action in the Cattegat the British flotilla has shown that it need not necessarily expect defeat at the hands of the more heavily armed German cruisers.

A London dispatch of Nov 3 suggests that the Germans have developed a device somewhat similar to the radio-controlled torpedo with which the United States has been experimenting for some time. The dispatch stated that the vessels patrolling the Belgian coast had been attacked by an electrically controlled high-speed boat. The boat was destroyed before it had done any damage.

It was announced by the British Admiralty on Nov 14 that a destroyer and a small monitor, which were operating in conjunction with the British expedition in Palestine, had been sunk by a submarine. Thirty-three men were lost.

There was a slight engagement between British and German light forces in the Heligoland Bight on Nov 17. According to the British report, the Germans were driven behind the protection of their mine fields after a pursuit of thirty miles. It was also stated that one German light cruiser was in flames, the machinery of another seemed to be damaged, while a mine sweeper was sunk. The German claim was that a British attempt to break into the Heligoland Bight had been repulsed without loss to the defenders.

The American destroyer *Chauncey*, which has been on patrol duty in European waters, was sunk in a collision on the morning of Nov 19. Twenty-one lives were lost.

Washington announced on Nov 24 the destruction of an enemy submarine by an American destroyer on duty in foreign waters. After the undersea boat had been severely injured, a line was put on her by the destroyer with the intention of bringing her into port. This was found to be impossible, however. It was unofficially stated that all of the crew of the submarine were captured. This gives to the Navy the honor of capturing the first German prisoners since the entry of the United States into the war.

—Aeronautics in

See also

AERONAUTICS—USE OF IN EUROPEAN WAR
DIRIGIBLES—USE OF IN EUROPEAN WAR
EUROPEAN WAR—LOSSES—AERONAUTICAL
RAIDS—AERONAUTIC

—Ammunition

See also

EUROPEAN WAR—MUNITIONS AND MUNITION MATERIALS

—Ammunition—Consumption

[Known Consumption of Ammunition, by Rifles and Artillery of Various Calibers, in the Bulgarian Army. *La Guerra y su Preparación*, Nov, '16. 240 words.]

During the campaign of 1915 the consumption of ammunition by the infantry was at the rate of 500 rounds per rifle. This extremely low rate is accounted for by the short duration of the campaign, the mountainous nature of the terrain (it does not permit the employment of great numbers of troops on the firing line), and the contempt which the soldier has for the rifle when it is possible to start a bayonet assault. Added to these is the fact that the Bulgarians, more

than any of the other belligerents, are compelled to exercise the most rigid economy in the consumption of ammunition, due to the fact that they have no governmen munitions plants.

The artillery pieces fired in this campaign, on the average:

Field pieces of 75 mm..........600 rounds
Howitzers of 105 mm..........330 rounds
Howitzers of 12 cm............500 rounds
Howitzers of 15 cm............280 rounds

—Ammunition—Supply

France

[Ammunition, Its Manufacture and Expenditure in France. Anonymous. *Schweiz. Zeit. f. Art. u. Genie.* 1000 words.]

When M. Albert Thomas, French Minister for Munitions, took charge, a gigantic task faced him. 50% of all workmen were at the front. Three-fourths of the French metal industries and coal product were then in German hands by the latter's conquest of the northern provinces. When the authorities realized that the existence of the nation depended upon the ammunition supply, a great number of workmen were recalled from the front.

In 1870-71 the German artillery fired a total of 817,000 rounds. At the battle of St. Privat alone 39,000 rounds were fired by them. The maximum per gun for any one battle was 200 in the Franco-German war, whereas at Tushitshao, in the Russo-Japanese war, one Russian battery fired 522 rounds per gun.

In the present European war the Germans have fired in a single day over 100,000 rounds along a front of only 8 km., and in Galicia the expenditure was even greater. The French communiqué of June 17, 1915, stated that north of Arras the French in the course of 24 hours had fired 300,000 rounds at the German intrenchments.

M. Thomas has not only put into operation all the old factories, but has also organized many new arsenals and ordnance factories. The center of the new industry is at Lyons, where the exposition buildings were used for national munition factories. Over 5500 workmen are employed here. Other establishments are Saint Chamond with 9000 workmen and Saint Etienne with 8000 workmen.

Great Britain

[Rate of Manufacture. *N. Y. Evening Post,* Mar 5, '17. Quoted.]

Dr. Addison, British Minister of Munitions, speaking recently at Bedford, gave some remarkable figures showing especially the increase of heavy artillery ammunition. He said that it was impossible, and would be undesirable, to give details, but he might give one or two encouraging illustrative figures. If they took the average weekly output of light field ammunition from July, 1915, to June, 1916, and then in the last completed week of January, and compared them, the figure would be in the first average of weeks 6½, and in January 22. For medium guns in the first period it would be 7½, and in January 76. For heavy guns the first figure would be 22, and the figure for the last week of January 365. The British army owed that overwhelming preponderance of heavy artillery to the genius and foresight of Mr. Lloyd George.

—Artillery in

See

ARTILLERY—USE OF IN EUROPEAN WAR
FIELD ARTILLERY—USE OF IN EUROPEAN WAR

[European War, Echoes of. XIII. The Artillery. By Jose Paulo Fernandes, Capt. of Artillery. *Revista da Artilharia,* Aug, '16. 4000 words.]

(Notes on the matériel and methods of field artillery in the present war, with a reference to the vast increase in importance of this arm in all countries, and the lessons to be drawn by the Portuguese army.)

—Asphyxiating Gases, Use of in

See

ASPHYXIATING GASES—USE OF IN EUROPEAN WAR

—Atrocities in

[Note quoted from London *Spectator,* Apr 14, '17.]

What has filled the hearts of Frenchmen with bitterness and rage has been the meticulous brutality, the sublimated dirtiness, the vagaries, as of some type of nauseous ape, which have disgraced the German retreat. Here are the instructions in frightfulness contained in documents found on prisoners lately taken on the Somme front, and pilloried in the *Times* by Mr. Ian Malcolm, who has most usefully specialized in exposing what we may term placarded blackguardism. No. 1, dated Mar 9, gives instructions for the procedure preliminary to the so-called German "withdrawal" on the British front, and runs as follows:

"1. Pioneer —— and 1 infantryman will throw dung into the wells.
"2. Pioneer —— and 2 infantrymen will cut down the trees.
"3. Pioneer —— and 2 infantrymen will carry out special tasks.
"4. Pioneer —— and 2 infantrymen will stack wood in houses."

No. 2 is a time-table to be carried out at Bancourt, a village just east of Bapaume:

"In the village of Bancourt it is more important to set fire to the houses than to blow them up.

"5th March.—Straw will be heaped up and tarred.

"10th March.—Explosives are to be ready for the cellars and wells in Bancourt.

"11th March.—All unused wells and watering ponds must be plentifully polluted with dung and creosote soda. Sufficient dung and creosote soda must be placed in readiness beside the wells which are still in use.

"12th March.—Bancourt must be ready to be set on fire.

"13th March.—Parade in fighting kit, issue of iron rations, cleaning of arms, instruction regarding safe roads to be used and instructions for the demolition party.

"14th March.—Explosives to be issued for destroying the cellars and wells in Bancourt. Bancourt Church tower will be blown up.

EUROPEAN WAR—Continued

"16th March.—All wells in Bancourt with the exception of one will be blown up by 6:30 p. m.

"17th March.—The road mines will be fired at 3 a. m. The remaining cellars in Bancourt will be blown up at 3:15 a. m., and Bancourt will be set on fire at 4 a. m."

And yet our pacifists still tell us that the Germans are just as good fighters and just as worthy citizens as the Allies!

[Present Policy of the War. By Hilaire Belloc. *Land and Water,* April 5, '17. 3200 words.]

The prolongation of the war has increased the necessity of an absolute victory.

This prolongation of the war tends to decrease the horror of, and therefore the reaction against, barbarism. It increases the desire of the enemy to destroy a civilization which he cannot attain and increases his practice in the means of destruction. Therefore it compels that civilization with every additional month to determine more and more upon the absolute elimination of such a menace. The enemy, under Prussian direction, during the progress of the war has gradually proceeded to break one after the other of what were before 1914 very sacred implied or expressed conventions of European civilized war.

This successive breaking down of military conventions still continues. It has not reached its limit and may be carried on indefinitely.

The new breaches of convention may be thus summarized in their order:

(a) Germany violated neutral territory, at first admitting it was a novel breach of law.

(b) She next organized considerable massacres of civilians in order to terrorize the civil population, and she accompanied these massacres by the destruction of civilian property.

(c) She dropped explosives upon the civilian population of open towns, also in order to obtain the military advantage of throwing confusion into civilian affairs.

All these first three things she did quite at the opening of the war long before any similar actions had been forced upon her opponents by her example.

(d) She next proceeded to sink enemy non-belligerent ships of merchandise without safeguarding the lives of the crews.

(e) She next began to use weapons hitherto regarded with abhorrence and set aside in modern warfare, notably poisonous gases and burning oil.

(f) She next proceeded to destroy the *passenger* ships of belligerents.

(g) The next step was the beginning of outrages against prisoners of war. This was the first of the Prussian actions not directly connected with military advantage.

(h) Next came the compulsion of prisoners of war to work for their captors in military services directed against their own countries. This was a clear military advantage and again quite new in the story of European warfare.

(i) The next step was the theft by military order and as an action of government of private property. This must be distinguished from loot, the action of individuals, which has occurred in all wars in various degrees. The policy is referred to of taking the private property of non-belligerents and transferring it to the permanent control and possession of the occupying power, without immediate military necessity of any kind.

(j) The next step was the compulsion of non-belligerent populations to servile labor for the advantage of the enemy's military and economic power.

(k) The next step was the destruction of all shipping, neutral or belligerent, without warning, wherever such shipping might be conveying goods or even medical aid to or from belligerents.

(l) The last step has been taken during the recent retirement in Picardy and consists in the complete destruction of the countryside over which a permanent retirement is taking place, including the poisoning of water supplies, the killing of fruit trees, and the destruction of every sort of building.

As a matter of fact things can go much further. There still remain the poisoning of water supplies at home by agents within the belligerent countries, the spreading of diseases among men and animals by other methods, private assassination, the massacre of prisoners, etc.

The only agent for recovering civilized practice is a complete victory. The power which acts in this fashion must be rendered impotent. The degradation of war as at present accomplished by Prussia can be prevented from becoming permanent only by the destruction of the center which boasts its power and desire to continue and increase these novelties, and which is in actual process of continuing and expanding them.

—Casualties

See

European war—Losses

—Cavalry—Use of in

See

Cavalry—Use of in European War
(Article: "Cavalry Tactics on the Western Line")
(Article: "With the Cavalry on the Western Front")

—Condition of Belligerents

See also

European war—Military situation
Germany—Military conditions in

[How Germany May Fail. Editorial. *Scientific American,* Nov 4, '16. 1800 words.]

If Germany is to lose, as the Allies firmly believe she must, wherein will she fail? A nation's strength is made up of many elements, military, financial, industrial, economic, human and moral. In a general siege, such as Germany is now undergoing, a nation may fail by (1) *starvation,* but the Central powers can raise enough food to support themselves; (2)

financial collapse, but with perfect co-operation between the government and the people, as exists in Germany, a war can be financed indefinitely; (3) *lack of guns and munitions,* but the central powers possess the necessary raw materials or have found substitutes, and the ammunition supply shows no diminution, tho aluminum is being used as a substitute for copper; (4) *failure in man-power,* and herein is where the central powers may fail. The officially admitted losses of the first two years are about 3¼ millions. Early in the war the lists were accurate, but later only a percentage was published. Even counting the yearly loss at 1½ millions, the annual supply is only about 600,000, and present evidence is that the central powers feel the pinch in man-power. There is evidence that Mackensen and Falkenhayn's forces are drawn, not from reserves, but from the eastern and western fronts.

[Austrian, Bulgarian and Turkish Reserves. By Hilaire Belloc. *Land and Water,* Dec 14, '16. 4100 words.]

The Great War can be expressed only as a junction of two factors: munitionment and effectives.

[Germany—the Land of Makeshifts. *Scientific American,* Feb 17, '17. 1800 words.]

Germans, in their feverish efforts to supply substitutes for articles which are scarce, have been successful in using in many ways aluminum, zinc and steel for copper, brass, bronze, tin, hardwood and ivory. Coarse cloth, rope and string are manufactured from paper pulp. Various weeds are substituted for cotton and wool. Experiments are being made to find substitutes for lubricating oils and gasoline. In this campaign whose slogan might well be "Waste Nothing," not even fruit stones are thrown away until the last drop of their oil has been extracted.

[German Disintegration on the West. By Edmund Dane. *Land and Water,* June 28, '17. 3000 words.]

The German front between Verdun and the sea still forms a huge and pronounced salient—a convex, which involves the maximum of exposure to attack with the minimum power of resistance to attack. Under pressure on both faces of the salient at one and the same time, it also means immobility.

To hold such a front calls for a great weight of troops, and there is a limit below which, so long as the front remains what it is, that weight of troops cannot be allowed to fall.

The Germans desire to retain as much of the territory of France as possible, or alternatively to hold it to ransom.. But despite that desire, the fate of their forces in France may come in the last resort to depend upon mobility. Self-preservation may necessitate a retreat. If so, they must be able to retreat as an army, or they will never retreat at all.

A withdrawal would be an operation of great delicacy and risk and as such strictly dependent upon the conditions imposed by strategy.

For many reasons the German government wants peace. But it wants a peace which will save the autocracy and the standing and privileges of the junkers, a peace that would enable Germany to dodge insolvency, otherwise certain; a peace that may be proclaimed *as a success.*

The question is how to bring about such a peace before American intervention begins actively to take effect. It is clear that with the military situation what it is, American intervention must be the last straw.

Adopting the present German point of view, the chief obstacle to such a peace will readily appear to be France. The only means of dealing with England is isolation. But France is possibly, from the German point of view, an obstacle that is removable.

It is possible that civilian agitation in France, and the openly expressed discontent with the French army and with its leading, have influenced German designs and given birth to German hopes. These ideas may account for the appearance against the French of the so-called *stosstruppen* or "shock-troops."

These troops seem to have been evolved from two sources—one, the selection from the army at large of the most physically fit men; the other, the transfer of "crack" divisions from the front in Russia and Rumania. The *stosstruppen* are the admitted product of a study of Allied tactics. With every successive draft upon it of this kind, the fighting value of the army at large is lowered. Further, every successive defeat of these shock-troops means for the German army a downward step which cannot be retrieved.

The repulse of the German attacks along the valley of the Ailette have been the withering of a great German hope.

The appearance of *stosstruppen* is a sign of disintegration because it is a sign of falling morale. The non-success of such a device is felt over the enemy force as a whole. To set up a distinction in this way between the mass of the army and a minority of "heroes" not only by implication reveals the limited confidence felt in the mass, but it inevitably causes the mass to conclude that where the heroic minority cannot succeed, it would be unreasonable to expect them to succeed. In the meantime disintegration proceeds apace.

[Germany's Boy-Power. *Army & Navy Gazette,* July 21, '17. 500 words.]

Information from prisoners and from papers found on the dead seems to leave no doubt that the (German) class of 1919 has already been called up, and that the 1920 class will be in the ranks by the end of this year. Many boys only just turned 17 will have joined the army before the full severity of winter sets in. Knowing the normal training given to German boys, it may be assumed that with the present need of soldiers these youths will not remain over-long at the depots or training centers. Many boys of 17 and 18 in outward appearance have the physique and stamina of men several years older, and a recruit can serve earlier in Europe than in the tropics. But Germany's man power must be very seriously depleted to force her to call up boys of 17 and 18. Hitherto in peace she has not called her classes until they were older

EUROPEAN WAR—Continued

than those called in neighboring countries.

[The "Nine Million" Effectives. By Hilaire Belloc. *Land and Water*, Sept 6, '17. 3400 words.]

Mr. Gerard's phrase "nine million remaining German effectives" must be regarded as wholly inaccurate. The German effectives—in the sense of combatant units—are at the most 3¼ millions organized in divisions and lesser units the numbers and positions of which have been ascertained and followed minutely as the war proceeds. Behind these effectives is an organized reserve power of men in depot, now very considerably less than a half a million (at which figure it stood ten weeks ago) but to be increased in a few weeks by the greater part of class 1919 and before the end of the year by nearly the whole of that class.

The present "ration strength" of the German Army may be put at about 5½ millions. This includes, besides the effectives already mentioned, somewhat over 2¼ millions, mostly men who are used to garrison, to supply, etc., but are too old for service in the field, or of men so affected by war in the way of wounds and illness that they can only be used for similar auxiliary purposes.

These last do not count among "definitive losses," that is, they are not out of the army for ever as are the dead, the prisoners and the discharged for physical causes; but neither are they capable of active service in the future. The only part of this balance between the total ration strength (5½ million) and the army in the field (3¼ million) that counts in the active strength of the enemy, is the number Germany has in depot. As already stated this number in June last was under half a million—excluding the class of 1919.

Austro-Hungarian Situation

The Austro-Hungarian forces organized on the fighting line are believed to number 81½ divisions. These divisions were distributed towards the end of November about as follows: 37 against the Russians; 12 against Rumania; 2 in Albania and Montenegro, and 30½ against the Italians. The grand total of men in the field, including auxiliary troops and those upon the communications within the zone of the armies approximates roughly 1,850,000 men. The reserve of man-power behind this field force is included in the following categories:

(a) The men now in the hospitals who may be released for some sort of duty between now and next August, in round numbers 250,000 men.

(b) Men previously rejected who may still be called upon (including those that can conceivably be spared from munitions, mining, internal communications, etc.), about 200,000 men.

(c) The younger classes including class 1918, about 150,000 men.

Thus the total reserve of available man-power behind the armies up to the middle of next summer is about 600,000 men.

Roughly speaking, Austria has been compelled to call nearly one class ahead of Germany and Germany, fully one class ahead of France. Austria-Hungary is the most exhausted of the principal belligerents because she has lost so many prisoners to the Allies.

Bulgaria

Upon entering the war Bulgaria mobilized every available man, including class 1916, and produced a force of 790,000 men. That force has not suffered severely. Its losses are probably still under 100,000 men. Her reserve of man-power is comprised almost entirely of classes 1917 and 1918, and at the most cannot exceed 100,000 men.

Germany

[The War on Land. By a Military Officer. *The Army and Navy Gazette* (London), Oct 7, '16. 1600 words.]

German prisoners complain that their units at the front are being worked to exhaustion. This means shortage of numbers on the western front, due to von Hindenburg's partiality for operating in the east. A garrison in one locality may have to work for an inordinate time, even tho its relief is there and ready to move, if our artillery barrage is blocking communication, but the complaints refer to something more serious. A whole division is left unrelieved till the men are worn out. When our artillery ceases and the infantry goes forward, exhausted groups of the enemy have little stomach for the clash.

[The War on Land. *Army & Navy Gazette*, Dec 23, '16. 2000 words.]

British and French reports indicate that the quality and morale of the German troops on the west front are diminishing. The British claim that but for the heavy rainfall in November, they should have captured Bapaume. The French victory at Pepper Hill was accomplished with four divisions against five German divisions, representatives of every regiment of which were counted among the prisoners and dead. It is likely that Hindenburg, in selecting troops for his campaign in the east, thinned out the good units from the Verdun sector where he did not approve of the offensive. Therefore, the Crown Prince was promoted from command of the Verdun sector to the command of a great group extending from Switzerland to the Champagne district, because it would be dangerous to the military prestige of the Hohenzollern dynasty to leave him with a defeated army to face General Nivelle.

Since the offensive of Loos and Champagne, in September, 1915, the British and French General Staffs worked to improve the methods of attack under modern conditions of armament. It was found that a precise plan of attack could govern only the opening clash. Commanders and their staffs must handle the situation as it develops, taking advantage of all extra gains. Thus opportunities often arise for a display of grand tactics in the midst of a battle. An instance of this was the French maneuver at Pepper Hill, when they took in flank and rear the German fortress on the Côte du Poivre.

[Storming Troops. By Hilaire Belloc. *Land and Water*, July 5, '17. 2700 words.]

The formation of "storming troops" in the German Army is an open confession of deterioration in the mass of the army.

Every belligerent force which has been suffering from the material and moral losses of three years of war has passed and is still passing thru a downward curve. Only those forces which grow slowly in the course of the war and have still large reserves of the best material untouched form exceptions to the general rule.

This deterioration has among other factors, the following:

(1) The larger proportion of older and younger classes necessary to replace the fittest classes, which have been worn down in the process of war.

(2) The mere effect of time and strain upon men who have held the field for long periods.

(3) The necessity of using over again, men who have been badly wounded or who have suffered a bad illness or shock.

These "storming troops" consist of battalions of specially selected men, picked for their physique, their character or their intelligence from all manner of units, and then subjected to special training. They are exempt from duty in the trenches and from fatigue duties and are taught to consider themselves superior to the rest of the army. When they are used they are distributed among other troops to form "spear heads," as it were, for the attacks contemplated.

The disadvantages of such a system of last resort are well known. The formation of the "storming troops" affords a good index of the degree of deterioration, itself the consequence of excessive casualties now obtaining upon the enemy's side.

The campaign during the last three months has resulted in the destruction of Hindenburg's "strategic reserve," the breakdown of the German plan for restoring a war of movement and the wasting away of German man-power at a far greater rate than the enemy had counted upon.

The "storming troops" come into use not in the moment of success, but after the moment when the sentiment of defeat is already heavy upon the army as a whole. An experiment of this kind is never tried until the latter phases of a losing fight—and only then as a desperate experiment.

[The Present Enemy Strength. By Hilaire Belloc. *Land and Water*, July 19, '17. 2600 words.]

Of the enemy as a whole the German Empire represents about one-half the numerical strength, and much more than half of his power of munitionment. The quality of the German troops is still superior to the quality of the other half of the enemy alliance.

The total number of people included in the German military organization on June 1st was nearly five and a half million.

It must be remembered, however, that the active force immediately in contact with the enemy, the men who occupy the trenches at the front, are a comparatively small proportion of the whole. The German Army at the time mentioned counted about a million and a half bayonets, of whom about one million were on the Western front and rather less than a half million on the East, from Macedonia to the Baltic. It is this million and a half of infantry that are suffering the heavy casualties of the present fighting season.

The reserve of man-power from which men are taken to replace these casualties amounts to between 450,000 and 500,000 men—supplemented by the class of 1919, the training of which has now begun.

It is estimated that the total casualties for the German Army as a whole from Jan 1st to June 1st were over 800,000 men, of whom some 40 per cent were "definite casualties," that is, men killed, taken prisoner, or so badly wounded that they cannot be used again.

[German Resources Failing at Crisis. *Official Bulletin*, Oct 10, '17. 600 words.]

The French High Commission to the United States report that Germany has made her supreme military effort, and that her resources are failing. To meet the Anglo-French offensives the Germans have exhausted their resources in men. They have been compelled to withdraw divisions from the Russian front, to form new divisions with the assistance of the class of 1918 and a part of 1919, and to replace the Landwehr on the Western front by picked troops from the Eastern front, in order to defend their Western lines. The practice of shifting valuable reserves from one front to another is prevented at present by the continuity and intensity of the Anglo-French onslaughts. The fact that the Germans engaged 108 divisions against the French and English from April 15 to June 15, 1917, and 15 divisions against the English at Ypres in the first ten days of this October, shows to what extent Germany is taxed on the Western front.

[The War on Land. *Army and Navy Gazette*, Oct 13, '17. 1200 words.]

The British have frequently captured documents during the past twelve months which tend to show German anxiety about the dwindling of their resources as compared with the British resources. At first there were warnings against lavishness in the use of ammunition and injunctions against the waste of cloth and boots. But later papers were found enjoining more care in the expending of lives. These papers were couched in terms that showed a real anxiety on the part of the German Command. The latest document written by Hindenburg concerning the air service is of great interest. After a general statement of the need for economy he worte: "We should be making a great mistake if we overworked and exhausted our aerial units, which are inferior in number to those of the enemy, by employing them several times on a single day. . . . We cannot prevent the enemy's aviators from plying continuously over our lines."

EUROPEAN WAR—Continued

Turkey

Estimates of Turkish reserves are the most vague and unsatisfactory of all. Last September some 50 divisions had been identified but they were at that moment in the most unequal condition. It would seem that eight divisions have been suppressed in order to strengthen the more depleted divisions remaining, so that the actual number now in existence is only 42. These are distributed about as follows: 22 against the Russians from Mesopotamia to the Black Sea; 6 in Arabia, including the Egyptian front; 5 in Anatolia, in Thrace and near Constantinople; 2 on the Galician front; 2 in the Dobrudja, one of which crossed to the west of the Danube recently; lastly, 1 on the Macedonian front opposite the English. These forces probably total about 625,000 men with a maximum available reserve of 250,000.

Summary

Ignoring such problems as the possible recruitment from Poland and Courland, or political changes such as the future belligerency of nations now neutral, the apparent reserves of man-power to the enemy as a whole between now and next August are in round numbers 2,000,000 men.

—Cost

[What the Belligerents Have Borrowed. By Georges Lévy, of the Académie des Sciences Morales et Politiques. *Revue des Deux Mondes,* Dec 1, '16. 9000 words.]

Since the beginning of the war, France has increased her national debt as follows:

She has borrowed from the Bank of France 6 billions 500 millions of francs. The interest is 1 per cent. a year up to the year following the conclusion of peace; after that 3 per cent.

She has borrowed 10 billions on short term notes (redeemable in from three to twelve months), interest 4 per cent. on notes that are redeemable in less than six months, 5 per cent. on those redeemable in six or twelve months.

She has also issued bonds (5 per cent.) redeemable not earlier than 1920, and not later than 1925. Other bonds redeemable not earlier than 1931 have been issued under various forms carrying various benefits to subscribers.

She has also issued bonds abroad, principally in England and the United States.

She has borrowed also a large number of stocks from their individual or corporate owners; upon these she can get money and credit abroad.

At the end of 1916 her deferred payment debt should be over 50 billions of francs, while her floating debt should equal half that sum.

England's debt is greater than that of any other belligerent for three reasons: First, because of her huge navy; second, because she pays her civil and military functionaries more than any other country in the world; third, because she has financially aided her allies. She has advanced considerable sums to Belgium, Serbia, Rumania, and has assisted Russia, France and Italy in the operations of their treasury departments.

England has had, therefore, to resort to means similar to those used by France to obtain money, but with two notable differences.

She has not required any permanent advance from the Bank of England. She has issued about 135 millions of currency notes. The currency notes are protected by a gold reserve, and are redeemable in gold; the difference between the amount of gold kept in reserve and the amount of them in circulation is what the people have loaned to the government. It is a peculiar kind of loan whose character is not so clear as that made on bonds, and of course it could not be extended beyond a certain point.

England, since April 1915, has used the French system in securing money. She has issued treasury notes, and bonds. Her national debt has more than doubled; she has borrowed since the war started 75 billions of francs.

In Russia, the first borrowing was simplified by the fact that the Bank of Russia is a government institution, whose capital is the property of the state. She has since issued short term treasury notes, and has made arrangements with England and France which open credit to her in London and Paris.

Italy did not enter the war till May, 1915, and prior to that time had to a large degree prepared for contingencies by means of war-profit taxation, by increasing the circulation in bank notes and coupons, and also by borrowing money. She has since floated additional loans.

Rumania obtained money from her national bank, and from an internal loan.

Germany has had recourse to the three methods that have been employed by most of the other belligerents; by means of increasing the fiduciary circulation, by the establishment of a floating indebtedness, and by means of long term bonds.

She has borrowed 47 billions of marks, which at par would represent 60 billions of francs.

Austria-Hungary has, to the extent of her strength, followed the methods of her ally.

It is noticeable that the rate of interest has increased in the successive loans of all the belligerents.

It is terrifying to think of the enormous debts with which the belligerents will be burdened at the close of the war. How will their people be able to endure these burdens? Those charged with conducting the affairs of state must have a clear vision of the needs of the hour, must thoroly study the various branches of national industry, and open as wide as possible the fields of private endeavor in order that agriculture, commerce, industry, and finance may prosper to the greatest possible degree.

[Belligerents' Debt Grows. Reserve Board Estimates Increase at $49,000,000,000. *N. Y. Times,* Jan 8, '17.]

The increase in the national debt of Great Britain, France, Russia, Germany and Austria-Hungary is esti-

mated by the Federal Reserve Board at $49,455,000,000 from the beginning of the war to the latter part of 1916, with the exception of Austria-Hungary, in whose case the estimate extends only to May, 1916.

The three Entente nations' share of the total is $29,000,000,000, and that of the two Central Powers $20,000,000,000.

This estimate, the board said, in tabulations made public today, does not cover the cost of the war, as large revenues of undetermined amounts have been raised by internal taxation. Following are the estimated national debt increases.

Great Britain, to Nov 11, 1916	$13,253,358,000
France, to Aug 31, 1916	8,038,500,000
Russia, to Dec 31, 1916	7,973,274,000
Total for the Entente	$29,265,132,000
Germany, to Oct 22, 1916	15,260,000,000
Austria	3,716,200,000
Hungary	1,214,000,000
Total for Germanic nations	$20,192,200,000

Great Britain's national debt, the board estimated, was approximately $15,163,750,000 in November, having risen from $3,449,813,150 in March, 1914. Loans to allies and dominions included in the grand total are estimated at from three to three and a half billion. France's total loans to her allies during the war are estimated at approximately $330,000,000.

The national debt of Russia has risen from 9,888,310,000 rubles Jan 1, 1914, to 25,229,936,000 rubles (about $13,114,886,720) at the close of 1916.

Banknote circulation in Germany has increased greatly during the war, as in other belligerent countries, the total of Reichsbank notes in circulation on Dec 7 last being placed at $1,652,271,000, as against $450,212,619 July 30, 1914. The cost of the war to Germany since Rumania's entrance is placed at about $524,880,000 monthly, and the last new credit granted by the Reichstag—$2,880,000,000—on Oct 27 last is estimated to be sufficient for about five months.

The number of subscribers to the various German war loans is placed at 16,928,057, the fourth loan, offered last March, having the largest number 5,279,645.

The figures were taken from foreign sources which the board considers reliable.

[The Cost of the Great War. *Independent*, Feb '19, '17. 400 words.]

The total cost of the European War up to Dec 31, 1916, is calculated from known appropriations and loans, and from estimates of other expenditures to be $61,769,000.000. It is divided as follows:

Great Britain, $15,374,000,000; France, $12,200,000.000; Russia $8,500,000,000; Italy, $4,000,000,000; Belgium, $490,000,000; Serbia, $330,000,000; Rumania, $250,000,000.

Germany, $14,600,000,000; Austria, $5,000,000,000; Turkey, $650,000,000; Bulgaria, $375,000,000.

[War Expenditure. *Nation*, Mar 1, '17. Quoted.]

"The war expenditure of the world," declared the German Finance Minister, in his budget speech of Saturday to the Reichstag, "exceeds 300,000,000,000 marks and not more than 100,000,000,000 is our share." By "our share," Count von Roedern was referring to the share of the Central Powers, and he was evidently estimating annual expenditure. His reckoning of the world's present war expenditure, translated on the usual basis into American values, would mean $75,000,000,000 per annum, $6,250,000,000 per month, and $223,000,000 per day. The estimate is striking; for in August, 1915, Dr. Helfferich, then Imperial Finance Minister, estimated $75,000,000 as the daily average war expenditure of all belligerents; one-third of which he estimated to have been spent by the Teutonic Allies, or $25,000,000, as against the present German estimate of $100,000,000. For Germany alone, the credit now asked is for $3,750,000,000 and is stated to cover the outlay of four months. This would mean $30,000,000 for Germany's present daily average, as against $16,700,000 estimated by Dr. Helfferich in the summer of 1915. These last-named figures, being reported by the German government itself, should be trustworthy, and the British Exchequer's weekly statements of the past four or five weeks have indicated a daily average war expenditure somewhat above $35,000,000, as against $16,000,000 in the same weeks a year before. In these figures for Germany and England it must always be remembered that England's war appropriations are very largely swelled by advances to her allies, and, presumably, that the German government is similarly burdened by the requisitions of Turkey and Bulgaria. Therefore the estimate of Berlin on the outlay of all belligerents combined may not be wholly accurate.

[Loans to Allies. *Independent*, July 14, '17. 200 words.]

In a little more than two months, over one-third of the authorized $3,000,000,000 loan to the Allies had been transferred. Great Britain has received $550,000,000, France $210,000,000, Italy $100,000,000, and Russia $100,000,000. The loans to Russia may be largely increased if the government makes a favorable response to the Stevens Railroad Commission's plea for more railroad equipment. Investors in 1916 advanced $814,000,000 to the Allies on the securities of their war bonds.

France

[Military Notes. France. Cost of the War. Reprint from *Le Journal. Memorial de Caballeria*, Mar, '17. 260 words.]

At the end of the second semester of 1916 the daily cost of the war was about 90 millions of francs, or 2700 millions of francs per month.

The total credits asked by M. Ribot and voted by Parliament from the beginning of the war to the close of 1916 are as follows:

	Millions of francs.
Five last months of 1914	6,589
Year of 1915	22,705
Year of 1916	32,351
Total	61,645

EUROPEAN WAR—Continued

During 1916 the sum of 5000 millions was expended exclusively for artillery matériel and 660 millions for aircraft.

Great Britain

[England's Financial Effort. A Study of England's Resources, Revenue, and War Expenditures. By L. Paul Dubois. *Revue des Deux Mondes.* Nov 15, '16. 10,000 words.]

[Cost of the War. *Canadian Military Gazette,* Nov 13, '17. 128 words.]

A select committee of the English Parliament reports that the gross war expenditure to the 30th of September is approximated at £5,000,000,000 (five billion pounds sterling.) To be set against this, £1,321,000,000 will be owing by the Allies, the Dominions and India. The dead weight national debt has been increased by £3,000,000,000. If the present daily expenditure is not increased, each six months of the war will add £1,000,000,000 gross to the debt. Despite the large advances from the United States, advances do not show any tendency to diminish, and further economics are necessary.

The committee reported that the Imperial general staff should be required to closely and constantly consider the comparative cost of alternative proposals before reaching any conclusion. Much economy could be effected in this way.

Russia

[On Internal Loans. By A. *Weekly Naval Review* (Russian), June 30, '17. 700 words.]

The expenditures on account of the war in Russia amounted to 6084 million rubles during the first year, and to 11,640 million rubles during the second year. The total expenditure up to Jan 7, 1917, has been 26,800 million rubles, while the expenditure since that date has been at the rate of 1250 million rubles a day. money issues. Little has, however, been actually obrequired to carry on the war: Taxes, loans and paper

Three ways existed for raising the mass of money tained from taxes, but from loans 25,220,936,895 rubles had been obtained up to the end of 1916. Considerable money has been secured from paper currency issues, the Imperial Bank having issued up to Apr 5, 1917, 10,590 million rubles of credit money. Naturally such large issues of this kind of money has resulted in cheapening its value, or, in other words, the prices of all articles has enormously increased.

Consideration must now be given to the issue of a popular loan, such as have been used by other nations engaged in the war; and in this connection it should be noticed what a very large proportion of the population has subscribed to these loans in other countries. The latest English loan was subscribed to by about 8,000,000 people, or nearly 1/6 of the population of the Kingdom, while the latest German loan had about 2½ million subscribers who gave 53 million marks.

United States

[Note. *N. Y. Times,* July 29, '17. Quoted.]

On the eve of entering the war the United States was enjoying a trade balance of about $4,000,000,000, and had a gold stock of nearly $3,000,000,000.

Great Britain had secured a private loan of $250,000,000 and France one of $50,000,000, all of which remained in the country. War relief had amounted to $50,000,000, most of which also remained in the country.

After entering the war a $7,000,000,000 credit was voted by Congress, soon likely to reach $11,651,194,000, and of the initial sum $3,000,000,000 was at once available for loans to the Allies. Of this $1,523,000,000 has been loaned. The people of the United States have considerably oversubscribed a national loan for $2,000,000,000, and private contributions to war charities have reached over $150,000,000.

Against this about the only money to be spent broad will be that expended to maintain our armies and fleets there, unless for convenience it be debited to our account.

The trade balance, the Liberty Loan, and the productivity of the country in general, in crops and manufactured articles, and the state of employment present a situation absolutely unique in the case of a country going to war.

A year ago the Allies had spent on the war $20,895,000,000 and the Central Powers, $14,225,000,000, making a total of $35,120,000,000 some of which ultimately flowed to the United States. The last twelve months have added $21,900,000,000 to this sum.

With the net income of the principal industrial corporations having increased from $244,367,576 in 1914 to nearly $2,000,000,000 ($1,366,040,933 on Jan 1, 1917), there seems no reason, whatever may become the indebtedness of the Government, why the country should not be able to pay for the war from its war profits for some years to come, unless, meanwhile, some of its chief debtors should go bankrupt or oust gold from its supremacy. But countries which have mines and the potential energy of waterfalls do not go bankrupt.

—Dirigibles, Use of in

See

DIRIGIBLES—USE OF IN EUROPEAN WAR

—Diseases in

See

SHELL-SHOCK
TRENCH-FOOT

—Engineering—Field Operations

See

ENTRENCHMENTS
RIVER CROSSINGS—IN EUROPEAN WAR

—Finance

Taxing War Profits

[A Critical Study of the Problem of Taxing Profits Accruing to Individuals and Corporations Thru Furnishing War Munitions and Supplies. By M. Raphaël Georges-Lévy of the Académie des Sciences Morales et Politiques. *Revue des Deux Mondes,* Oct 1, '16. 7400 words.]

Several of the governments now engaged in hostilities, as well as certain neutrals, are confronted with an economic problem, arising from the situation among citizens financially affected by the various industrial conditions incident to the war.

While certain taxpayers have severely suffered financially, others have profited enormously. It has therefore seemed just, and necessary, to impose a special tax upon those who are being enriched by war industries.

The tax on war profits, properly speaking, should affect only the profits in excess of those that might be considered as normal. The term normal must be taken to mean the average of those profits realized by the taxpayer during a period of time previous to Aug, '14.

Different governments have attacked the problem in different ways. Certain legislators, instead of seeking to determine directly the profits obtained due to the war, have found it simpler to consider only the financial condition of citizens at a given date, as compared with that at a previous date. Under a third system, the past has not been taken into consideration; but the income has been examined in relation to the capital invested, and the excess over a given rate of percentage has been specially taxed.

In such a case one might tax war incomes that are actually lower as to percentage earned on invested capital than the corresponding peace incomes; this would be true where the minimum exempted rate is lower than that actually earned before the war began.

In France, where most of the profits have been made thru contracts with the Government, an effort has been made to cause a portion of the money gained by especially fortunate citizens to revert to the public treasury.

This idea seems to accord with the sentiment of equalization of burdens; it lightens those of the less fortunate taxpayers who, instead of profiting, have suffered from the war conditions. It has the defect of not reaching the profits obtained by foreigners, thru contracts or commissions, and the profits of those, who, while residing in France, are interested in factories not situated on French soil.

The law, as enacted in France, aims at the profits made since the beginning of the war, and at those that will be made during the period of twelve months following its termination. Certain persons, for example, the farmers who sell their crops directly to the state, are exempted from the operation of the law.

The normal profit (exempted) was fixed at 5000 francs (about $1000), or a percentage equal to 6% of the capital invested. The war tax levied is 50%.

For brokers and middle men, upon whom it falls the most heavily, the tax is calculated upon the total profits; for other individuals and corporations, it is calculated upon the excess of profits over and above 5000 francs.

In England, a law taxing war profits was enacted in 1915. It covers the period from Aug 4, 1914, to July 1, 1915. It absorbs 50% of the excess of profits realized by merchants and industrial organizations, provided the excess exceeds 200 pounds (about $1000); an excess of less than that sum is not taxed. A prewar standard of profits is determined for each case. A minimum (exempted) percentage of income has been established; this is 6% in certain cases, 7% in others. The law defines the term capital.

The trades and businesses affected are those carried on in the United Kingdom, or elsewhere engaged in by persons who reside in the United Kingdom.

Certain exceptions are made. Certain plants working more particularly than others for the national defense, are under direct supervision by the government, and retain only one-fifth of the excess of profits over and above the statutory 200 pounds.

In Germany, the increase of the patrimony, or fortune itself, is considered as the basis for assessment of taxes. The law affects the increase of fortune of individuals during the period from Jan 1 1914, to Dec 31, 1916.

The tax lists provide the necessary information, so it is not necessary to make special investigations to determine normal or average earnings. Inheritances are not taxed under the law, unless the deceased had before his death himself increased his fortune during the war. Certain other increases are also exempted, such as donations and insurance. The legislators made it a principle to tax not only the profits due directly to the war but increases in fortune due to any other cause. They believe that those whose fortunes have been increased should give a portion thereof to the fatherland.

The law takes into consideration the increase in the cost of living. Sums exceding 1000 marks that have been invested abroad, or spent for precious metals, precious stones, objects of art, etc., are included in the computation of fortunes.

Increases of less than 3000 marks are not taxed; fortunes of less than 6000 marks are not considered. Taxpayers who, prior to Jan 1, 1917, shall cease to live in Germany, shall not, for that reason, be exempted.

The tax varies from 5 to 25% on a graduated scale of increase.

In Italy, a tax on war profits was established Nov 21, 1915. It covers the period from Aug 1, 1914, to the middle of 1917. There is a graduated scale of taxation.

The question of the definition of capital received careful consideration. For corporations, not only the sum invested, but that held in reserve, is considered as capital. Expenses of establishing plants for the operation of war industries may be counted as capital.

Incomes are not taxed under the law unless they exceed 8% on the capital. The spirit of the law is to reach only increases of income due to the war.

In Holland, a somewhat similar law has been enacted. The tax levied is 30% of the increases. A sixth of the revenue thus obtained is diverted to a fund intended to succor districts which have particularly suffered on account of the war.

Denmark, Sweden, and Norway have all enacted laws imposing special taxes on war profits.

In the United States a law was proposed which would place a tax of 5% on the receipts under one

EUROPEAN WAR—Continued

million dollars of manufacturers of explosives, and 8% on receipts above that sum.

Manufacturers of cartridges, projectiles and weapons of war were to be taxed upon their gross receipts, from 2 to 5% according to the magnitude of their receipts. Copper smelters and refining plants were also to be taxed.

Another bill proposed taxing net profits instead of gross receipts.

A comparison of the laws enacted in various countries reveals certain interesting differences.

In France and England, war profits have been taxed without seeking to determine whether or not the excess of profits over the normal is due to present conditions. In both countries 6% has been established as a normal income from invested capital, and incomes below that rate have been exempted from the special tax.

Regulations have been prescribed for striking balance sheets, and these are much more detailed in England than in France.

In England, only merchants and business men are taxed; in France, licensed dealers and middle men are taxed.

The special exemptions vary in the two countries.

The normal profits are determined in France from the average of the three preceding years; in England, the taxpayer may select the two most favorable, and may go back in some cases to the sixth year before the war.

In Italy, for those engaged in commerce and industry, no comparison is permitted with the past. Profits are taxed in proportion to the income yielded by the capital. 8% is taken as the minimum limit exempted from the special tax. The tax becomes heavier as the income increases.

In Germany, it is the individual fortune which is considered. All increases are taxed whether or not due to the war.

In the United States, the various proportions investigated by Congress, tend to tax only a limited category of industries, those engaged in manufacturing arms and munitions of war.

The tax is 50% in England and France. In Italy it does not rise above 38%. In Germany it rises to 25% of the increase in fortune, and may in addition take nearly half of the supplementary income; but it is applied to a three-year period, and affects the income only if it has been capitalized.

England will receive the greatest revenue from the taxes on war profits; it has been estimated at 86 million pounds. The amount to be realized in France has not been stated.

The greatest danger from taxation of this sort is that of discouraging the spirit of economy. Those, who work in order to acquire or to increase a patrimony will cease struggling to attain their end if they see the State claim an ever increasing portion of the capital created by their efforts.

This consideration should never be lost sight of. The errors made may lead to the gravest consequences, from the point of view of national welfare.

Let us beware of a tendency to which we have yielded too readily and too often—that of imitating foreign legislation, without taking into consideration the fundamental differences which distinguish certain other people from our own.

—Food and Commodity Prices and Supply

Germany

[Is Germany Starving? *Independent,* Jan 29, '17. 600 words.]

Altho the neutral world is dependent upon what the English papers are allowed to print of what little they are able to learn about the food situation in Germany, it cannot be doubted that the Central Empires are seriously short of food and other necessities, such as leather, cotton, copper, rubber, and coal. Whether this shortage is so great as to interfere with further military operations cannot be told. The potato crop which carried Germany thru last year, was a failure last summer. Only twenty million tons were yielded, whereas the usual crop is fifty million tons. The butter allowance is two ounces a week. War bread allowance is four pounds a week. Only infants are supplied with milk. Meat and eggs, when obtainable, are four times the ordinary price. Rice, coffee, and tea are limited and expensive. A substitute for sugar, which is scarce, is saccharine, a coal-tar product, several hundred times sweeter than sugar, but of no nutritive value.

Herr von Batocki's plan for food distribution has not been a success. He is now endeavoring to establish a regional system by which the farmers of a given locality shall be responsible for feeding the towns dependent on them.

[How America is Supplying Germany. By F. Bohn. *New York Times,* Apr 11, '17. 1000 words.]

For the last two years Germany has carried on the war largely on supplies coming from the United States. For example:

	Fiscal Year, 1913.	Calendar Year, 1916.
Goods exported to Norway	$8,391,458	$66,207,744
" " " Sweden	12,104,366	48,353,387
" " " Switzerland	826,549	13,654,256
" " " Denmark	18,687,791	56,335,596
Total	$40,010,164	$183,551,153

These sums have been expended for cottonseed meal and cottonseed cake, wheat, flour, corn, illuminating oil, oleo oil. In other words, Norway, Sweden, Denmark, the Netherlands [amount spent by this country not given.—Ed.], and Switzerland are the economic allies of Germany. Hence, seeing that we are now at war with Germany ourselves, either these countries must stop all commerce with Germany, or we must stop all commerce with them. The justice of this procedure is almost self-evident. If we sell to Denmark, and the Danes make arms, ammunition and equipment for Germany, we shall be getting Germany's gold for supplying arms against our allies, just as much as tho the arms and ammunition had been shipped from Bridgeport.

An embargo should be placed to-day on all exports to these so-called neutral countries. Once they agree to our conditions, the embargo can be lifted.

Great Britain

[The Food Problem. Imports and Home Production. By R. P. Hearne. *Sphere,* Mar 3, '17. 1200 works. Notes and special diagrams.]

The essential foods are wheat, meat, potatoes, and sugar. Germany's potato crop in 1916 failed by reason of bad weather. She produces a surplus of sugar. Diagrams showing Great Britain's food products show too great an area under grass. The same lands under cultivation would support a greater number of people.

(Reference to these diagrams shows that of a total area of 77,000,000 acres, acreage is distributed as follows: Wheat, 2.3 per cent; other corn crops, 8 per cent; all other crops (excluding hay), 5.7 per cent; hay and clover, 17.4 per cent; permanent grass, 27.3 per cent; uncultivated land, water, town sites, etc., 38.8 per cent. Another diagram shows that 60 per cent of the total food is home-grown and 40 per cent imported. The chief imports are cereals, meat, fruit, potatoes, and sugar. Four-fifths of the cereals used are imported.)

—Forces Engaged

[Military Notes. Editorial. *Russky Invalid,* Feb 6 (19), '17. 600 words.]

From the best sources of available information the strength of the hostile forces confronting the Entente Allies is:

(*a*) On the Russian front, about 1000 miles, 165 German, Austrian-Hungarian, Bulgarian and Turkish divisions.

(*b*) On the France-Belgian front, about 400 miles, 132 divisions, all German; being an average of a division to about every three miles of line to be held.

(*c*) On the Italian front, about 220 miles, 30 Austrian divisions.

(d) On the Albanian-Macedonian front, about 250 miles, from 18 to 20 divisions, furnished in part from all of the Central powers.

Altogether Germany and its allies have in the field in round numbers 350 infantry and cavalry divisions, exclusive of forces operating in Asia, with a strength of approximately 4,000,000 men.

[Note. *Army & Navy Jour.,* Oct 27, '17. 150 words.]

The War Department has made a compilation showing that 38,000,000 men are bearing arms in the war, 27,500,000 on the side of the Allies and 10,600,000 on the side of the Central Powers. Germany has 7,000,000, Austria 3,000,000, Turkey 300,000, and Bulgaria 300,000. Russia has 9,000,000, France 6,000,000, Great Britain 5,000,000, Italy 3,000,000, Japan 1,400,000, United States more than 1,000,000, China 541,000, Roumania 320,000, Serbia 300,000, Belgium 300,000, Greece 300,000, Portugal 200,000, Montenegro 40,000, Siam 36,000, Cuba 11,000, and Liberia 400. These figures are not regarded as entirely accurate, but they represent in round numbers the comparative strength of the contending armies.

Austria

[The War in Europe. Belligerent Armies. Austria-Hungary. By General Malleterre. *Revista Militar* (Portugal), Dec, '16. 2200 words.]

Austria-Hungary is an assemblage of many nationalities under one government or political head. Austria has a population of some 11,000,000 people and Hungary 10,000,000, yet the empire comprises some 50,000,000 inhabitants, composed of countries or parts of countries under the domination of either Austria or Hungary. The war has demonstrated the great differences that exist between these people comprising the empire.

This difference is well illustrated by the defection of two regiments of Czechs and Croatians which was the prime factor in the gains of the Serbs and Russians in 1914. Two regiments of Czechs, the 18th and 36th, had to be disbanded because of their attitude in front of the enemy.

The great number of prisoners taken by the Russians is explained by the fact that so many men took advantage of the opportunity to desert. The Austro-Hungarian government was compelled to adopt the most rigorous methods in Bohemia, Croatia, Dalmatia, and Bosnia, in which countries a great number of notable men were either executed, imprisoned, or became fugitives.

At the beginning of the war the Austro-Hungarian army consisted of 16 Army Corps of two and three divisions each. The annual contingent was between 220,000 and 230,000 men, and these divided into the different classes.

As a result of policies of long standing, she had great latent resources at the beginning of the war, but her internal dissensions made it difficult to maintain regiments on the front at full war strength. In order to meet this regimental shortage, depot battalions were formed.

These battalions, called the Ersatz-battalions, are composed of 2000 men divided into four companies of 500 each. Each month 1000 men are sent forward to regiments requiring them, and 1000 new men are called up. The depots of the Hungarian army number 19, and these keep regiments of what is called the Honved supplied. The Landwehr of Austria has but 18 depots.

The Austro-Hungarian army consists of two parts: one is made up of the army of the Emperor, and the elements for this are recruited in both Austria and Hungary at the same time; the other reflects the character of the dual monarchy and is also subdivided into two parts, of which the first is essentially Austrian and the second Hungarian. The Austrian part is the Landwehr and the Hungarian part is the Honved.

The home stations are now occupied by the classes of 1885 to 1887. In the fall of 1915 the necessity was so great that the men who had completed their military obligations were called to the colors. Thus the classes of 1918 and 1881 to 1885 were called at the same time.

In face of almost insurmountable difficulties it has been impossible to form new units. The question

EUROPEAN WAR—Continued

arises, has Austria-Hungary exhausted her resources in men as well as in finances?

Canada

See also

CANADA—EXPEDITIONARY FORCE FOR EUROPEAN WAR

Central Powers

[Notes of the European War. *Army & Navy Jour.*, Feb 3, '17. 120 words.]

A London dispatch to the *New York Times* gives the latest estimate of the Central Powers' strength as follows: Western front, 128 divisions, or, 2,560,000 men; eastern front, 135 divisions, or, 2,700,000 men; Macedonia, 240,000 men; Italian front, 660,000 men. There are two Turkish divisions in Russia, two in Rumania, and one in Macedonia. There are eight divisions of Bulgarians in Macedonia and four in Rumania, or, a total of 240,000 Bulgarians.

France

[French Armies Now Number Nearly 3,000,000 Men. *Official Bulletin*, Aug 4, '17. 1200 words.]

In a letter to the Secretary of War, M. Andre Tardieu, special commissioner from France, says that the strength now present in the zone of the armies alone is a little less than 3,000,000 men, the maximum figure reached during the war, and exceeding by over a million the number in the zone at the beginning. These numbers are exclusive of men in the zone of the interior and in the colonies, and it is certain that these numbers can be maintained for a long time to come.

The percentage of definite casualties has been decreasing, from 5.41 per cent of the mobilized strength in the battles of Charleroi and the Marne, 2.39 per cent in the first six months of 1915, down to 1.28 per cent in the second six months of 1916.

Of the total western front of 739 km., the Belgians hold 27 km., the British 138 km., and the French 574 km. Forty-two German divisions are in front of the British, and 81 opposite the French. A German division holds an average front of 4.7 km., and a French division 5.5 km.

The French have had enough 75 mm. guns since the beginning. The 300 heavy guns of August, 1914, have increased to 6000 (mostly modern) in June, 1917. In the present offensives, the French have had one heavy gun for every 26 meters in the sectors attacked, and of trench, field, and heavy artillery, one gun for every eight meters. The ammunition output in August, 1914, allowed 13,000 shots from the 75's per day. Now the figures are 250,000 rounds from the 75's and 100,000 from the heavy guns per day. In one of the last offensives, 1442 kilograms of projectiles were used per meter of front attacked, and 12,000,000 projectiles of all calibers were used in the last offensive. The French also completely re-equipped and re-armed the Belgian, Serbian, and Greek armies, in addition to furnishing over 800 heavy guns to the Allies.

France has expended since the beginning of the war 82,647,000,000 francs; received foreign loans of 6,000,000,000 francs; and loaned 4,000,000,000 francs to the various allies.

Great Britain

[Britain's Army. *Army & Navy Gazette*, Dec 23, '16. 350 words.]

One million men are to be added to the British Army, bringing the total to five millions, exclusive of the troops serving in India and of the forces raised and maintained by the various Dominions.

[Irish Recruiting. *Army & Navy Gazette*, Dec 30, '16. 300 words.]

Ireland has furnished since the outbreak of the war 106,548 recruits, or less than 2½ per cent. of her population. The rest of the British Isles has furnished 10 per cent. of the population.

Japan

[Japan's Part in This War. Editorial. *Army & Navy Jour.*, Nov 25, '16. 900 words.]

Japan is profiting financially by the assistance she is rendering her allies, but at the same time her help is of great importance to them.

Japan has furnished great numbers of rifles to Russia as well as furnishing rifles for Kitchener's army and guns for the British navy.

In Nov, 1915, the Japanese Foreign Minister stated that Russia was able to arm only one-third of the men then mobilized and Japan was arming the rest. The Japanese rifles are as good as the American and only about one-half the price.

In Sept, 1914, the Russians were using Japanese heavy siege guns. At the time of the Russian retreat from Warsaw, Japan had furnished about 750,000 rifles, enough to arm 52 divisions, together with a considerable quantity of field guns, besides heavy guns. These helped to stay the retreat of the Russians.

Large quantities of cloth, boots and all other articles of equipment have also been furnished to all the Allies except Italy.

The Japanese navy has protected the commerce of the Allies in Pacific waters, and has seized the Marshall, Caroline, and Ladrone islands. Japanese cruisers have convoyed Australian and New Zealand transports to Egypt. Squadrons aggregating 225,000 tons have constantly co-operated with the British fleet. Two battleships and one armored cruiser formerly of the Russian navy, sunk, raised and refitted by the Japanese, have been returned to Russia for a consideration. Japan has gained immensely in her capacity for manufacturing war material and has formed new friendships.

Turkey

[The Turkish Strength and Its Disposition. By Hilaire Belloc. *Land and Water*, June 14, '17. 1400 words.]

The Turkish Armies in Asia consist of some 36 divisions which, prior to the Russian Revolution, were in three main categories, as follows:

(1) The comparatively small forces operating at

distant points; guarding Palestine, sent against the revolted Arabs further south; holding the front which covered Bagdad; operating in Persia.

(2) A certain number of divisions kept in reserve behind the armies in Syria and in the region of Diabekir.

(3) For the most important, a large group of divisions preparing to resist the pressure of the Russian armies based on Erzerum and Trebizond.

Actually, nearly half of the entire Turkish armies were held by the Russians in Armenia. The new Russian situation may enable the Turks to withdraw large forces from Armenia so that the two British armies, in Palestine and in Mesopotamia, may either of them meet in the near future with much stronger opposition than they have felt in the immediate past.

The value to the enemy of striking upon the Palestine front is not very apparent. It would be easier and more profitable for him to reinforce the small force, reported as five divisions only, with which he was operating on the Bagdad front.

A successful operation on this front would yield more fruit politically than upon any other.

United States

[From *The Fortnightly Review,* Mar, '17. Quoted.]

Should war be forced on America we are likely to find the Americans much better prepared to enter into the struggle than is generally supposed. No attempt would at first be made to send an expeditionary force overseas, since time would be required to complete the equipment of the organized units, but, taking into account the marvellous powers of energy and organization with which our new Allies, if such they are to be, are endowed, it would not be surprising if, in the course of the next six months, we saw American contingents fighting alongside of French, British or Russian troops. Perhaps the most effective help which America could forthwith bring to the cause for which the Allies are fighting is contributions of munitions of all kinds — guns, rifles, ammunition, airplanes, and motor transport. The Allies have a preponderance of men, and all that is wanted for decisive victory is a corresponding and overwhelming preponderance of war *matériel.*

[The War on Land. *Army & Navy Gazette,* Apr 7, '17. 2500 words.]

Certain units of the American forces may well be able to appear in the European theater during the summer, coming into it for the purpose of gaining experience. If America can have by next mid-winter a force of a half a million approaching near to fitness for the field, with several hundred thousands undergoing preparation as reserves, the very fact might have a most decisive effect on the war, or rather on its duration.

["Old Glory in France." *Army & Navy Gazette and Broad Arrow,* May 12, '17. 310 words.]

The impression gathered from what Marshal Joffre has said in Washington seems to be that he advocates the sending to France of a small, thoroly equipped, American unit as soon as possible rather than that delay should result from waiting to transport a really large army. The objections to the despatch of a really substantial body of troops across the Atlantic at the present time are many and obvious; such action would delay training in America, while the transport and maintenance of an army from so distant a base would take up shipping already urgently needed by and for the Allies. The moral effect of the presence of an American force in France, however small, would be very great; the French would see with joy and pride the presence in their midst of the sons of the nation which Royalist France helped to make free, and there is certainly a very strong feeling in America that the sooner "Old Glory" is unfurled on the Western Front the better.

America is already helping enormously the cause of the Allies with money, shipping, material, aviators and medical officers, and while, for sentimental, moral and spectacular purposes, the despatch of a small American unit would be very welcome, Marshal Joffre probably expressed the feelings of most soldiers now fighting when he deprecated the sending of any really substantial force before it is thoroly trained, or its provision with reserves and munitions can be absolutely assured.

[To Call Entire National Guard. *Army & Navy Jour.,* May 19, '17. 1700 words.]

The War Department has issued orders for calling the entire National Guard into the Federal service in three increments, July 15, 1917; July 25, 1917, and Aug 5, 1917. After a short stay at local armories for distribution of equipment, the Guard will be sent to "Divisional Cantonment Camps." These same camps will be used, as soon as the National Guard has been trained and withdrawn, for the troops composing the new National Army. These camps will be established as follows:

Northeastern Department, one; Eastern Department, four; Southeastern Department, twelve; Central Department, six; Southern Department, six; Western Department, three.

The organization of the National Guard will be as follows:

Sixteen divisions (numbered from 5th to 20th, inclusive) composed of: 144 regiments of infantry; 16 regiments of cavalry; 48 regiments of field artillery; 16 regiments of engineers; 16 field battalions of signal corps troops; 15 aero squadrons, and the necessary sanitary and supply trains. Supplementing the mobile forces will be 212 units of coast artillery.

[Our Expeditionary Force in France. *Army & Navy Jour.,* July 7, '17. 900 words.]

Between June 26 and June 30 all the units of the first Expeditionary force of the U. S. regular army arrived safely at a French port, and went into camp a short distance therefrom. (Follows a description of non-essential details.)

A battalion of infantry went to Paris, July 3, to participate in the 4th of July celebration.

EUROPEAN WAR—Continued

Fifty American aviators arrived at Nice, France, on June 22 to undergo a course of instruction at the seaplane depot.

—Fortifications, Experience with

See also

ENTRENCHMENTS—USE OF IN EUROPEAN WAR

[Experiences from the Fortress Battles During the World War. *Svensk Kustartilleritidskrift,* Part 4, '16.]

(Translated from *Journal U. S. Artillery,* by B. Ygge.)

—Fortifications, Use of in

See

FORTIFICATIONS — FIELD — USE OF IN EUROPEAN WAR

FORTIFICATIONS—PERMANENT—USE OF IN EUROPEAN WAR

—Grenades, Use of in

See also

GRENADES—USE OF IN EUROPEAN WAR

—Hospitals in

See

HOSPITALS—IN EUROPEAN WAR

—Losses

[The Calculation of Enemy Wastage during the Present War. (Synopsis of a lecture.) By Hilaire Belloc, Esq. *Jour. Royal Artillery,* May and June, '16. 2000 words.]

Calculation of an enemy's wastage is dependent upon the following evidence:

(1) His own lists, if any.

(2) Evidence supplied by the Intelligence Departments of the staffs opposed to him.

(3) Evidence (in check) afforded by less general enemy statistics, *e.g.,* losses in a particular arm, district, or trade, published separately from the official lists.

(4) The analogy of other belligerent losses, especially our own.

(5) In certain categories (*e. g.,* deaths from disease), the evidence of the death rate in time of peace.

To these must be added a large number of subsidiary, less exact, and less valuable methods, such as the analogy of losses in the past, the appearance of inefficients among recruits after a certain date, and the general impressions of neutral travelers.

The calculation includes the following elements:—

(1) Gross wastage as measured in numbers and units of time.

(2) A deduction from these for those who return, *e.g.,* sick and wounded who are cured and return to their original service.

(3) The number of men at that moment who will ultimately return to service, but who are as a fact not yet returned.

Of the four portions of the enemy's forces, the losses of only one—the German—can be exactly analyzed.

For the estimate of the German wastage we have the following evidence:—

(1) The enemy's own lists.

(2) The result of the intelligence departments on our side, particularly the British and French.

(3) A considerable number of particular cases of evidence; the losses sustained by certain trades and corporations.

(4) The analogy of our own losses which are known accurately.

That the enemy's lists may be deficient and delayed may be checked by comparison with lists of prisoners with the dates of their capture, and of the identification discs found on the dead. The exact average deficiency of the lists, it is difficult to determine.

From a study of all evidence, the conclusion of the French General Staff is that the average German wastage is about 200,000 per month. This estimate may be verified by the facts that it is known that the Germans have created no new formations since February, 1915, and that all thru the spring and summer of 1915, average drafts of 200,000 per month were called.

From our own losses we get an average of about 6% per month for all arms acting in any fashion in the field. This percentage applied to the German numbers would give a dead loss of 3½ to 4 millions to the end of 1915; which corresponds very closely to the figures arrived at by taking the average of 200,000 per month for the 17 months of war to the end of 1915.

[Losses. From "Germany Strikes Rumania." By Frank H. Simonds. *Review of Reviews,* Nov, '16. 800 words.]

During the past month [October] the losses in the Battle of the Somme, have been exaggerated by both sides. The Germans asserted that the Allies have lost a round million. The French and English claimed a total German loss of about 600,000 of whom 100,000 were prisoners. Now the French concede 250,000 at Verdun; the Germans admit a casualty list a little larger, and at about half that stated by the French in the same battle. The British officially admit a loss of over 300,000 during three months of fighting, chiefly at the Somme. If French and German losses were equal at Verdun, there is no reason why German and Allied losses should not be equal on the Somme. But there is reason to believe that the Germans have underestimated their Verdun losses, and neutral observers agree that the total of these foots up 500,000 at least, or twice as many as the French. If we accept this ratio, then the Germans have not lost more than half as many men as the Allies in the Somme operations. We may put the British losses at 400,000 for four months' fighting; those of the French have been much smaller, probably not more than 100,000. Conceivably, therefore, the Germans, if the rate of capture of prisoners holds, will have lost 300,000 in four months at the Somme (250,000 as against 500,000 Allied, and prisoners), or at Verdun and the Somme together, between 750,000 and 800,000 men, as compared with

400,000 British and 350,000-400,000 French. Now it is to be noticed that this whole loss on one side has been borne by the Germans, while it has been, roughly, equally divided on the other. If we add casualties on the eastern front, where the fighting has been very severe, it is hard to see how the total German loss for the year can be less than 1,000,000. Put in another way, while Russians (against the Germans), British, and French have been losing 400,000 each, Germans have been losing 1,000,000.

Turning to Austria, she can not have lost fewer than 750,000 since Jan 1, 350,000 by capture (the Russian official accounts give 420,000), 100,000 in Italy, and 300,000 by casualties proper (death and wounds) in Galicia and Volhynia. Over against this, let us set down 1,000,000 (German statement) as the Russian loss since June 1. The Italians must have lost at least 150,000. Summing up, we have 1,750,000, borne by the two Central Powers, as compared with 1,950,000 borne by the Allies. But if we take the ratio of their respective losses to the population behind them, it is clear that the Central Powers have suffered more seriously than their adversaries. Moreover, of the Austro-German losses, 550,000 have been in prisoners, while the Allied loss in this respect is not one quarter as large, even if we include the first Verdun bag.

[*N. Y. Times*, Dec 17, '16.]

On Dec 6 a report was received from Berlin to the effect that the Association for Research into the Social Consequences of the War of Copenhagen had given out the figures of Entente losses as 15,100,000. The separate figures stated are: Great Britain, 1,200,000; Russia, 8,500,000; France, 3,700,000; Italy, 800,000; Serbia, 480,000; Belgium, 220,000, and Rumania, 200,000. At the end of the second year the following estimates, from various sources, were announced: Estimates of casualties based on official data show that the second year of the war cost more than 3,000,000 lives and inflicted wounds on more than 6,000,000. Estimates for the first year ranged between the German report of 2,500,000 killed and more than 5,000,000 wounded to Beach-Thomas's estimate of 5,000,000 killed and 7,000,000 wounded. Up to the period of the Somme offensive and the Brusiloff drive, both of which began toward the end of the second year of the war, the British had lost in killed or totally incapacitated, 228,138; in prisoners, 68,046. German losses were: killed or totally incapacitated, 664,552; prisoners, 137,728. France gives out no figures, but Deputy Longet estimated the losses in killed and totally incapacitated at 900,000; prisoners, 300,000. German reports of Russian casualties amounted to 3,000,000, of whom 1,000,000 were prisoners.

[Casualty Rates Compared. *The Canadian Military Gazette*, Jan 9, '17. 1250 words.]

The official French and British reports for the past few months show that the Allies' casualties, compared with the number of men engaged, have been steadily falling off, and this is spite of the fact that the British army, only recently come into its full size, is engaged in attacking which costs more men than does defending. This does not mean that the present day Central Powers soldier is not as good a fighter as the picked men who first invaded Belgium—he may even be better—but it does at least mean that the Allies have learned the new fighting game thoroly and now have what the Germans had at first—a great superiority in munitions, which enables the guns to do now what the men had to do at the beginning of the war. Also, the Allies have a superiority in men which enables them to carry off an attack swiftly and therefore with less danger to the troops making it.

The duration of the war, however, depends on Germany's casualties, for now that country is sure to to be exhausted first. Austro-Hungarian ranks are already so depleted that German divisions are called upon to strengthen the Austrian line in the East. Since the fall of Monastir, Bulgaria will fight only on Bulgarian fronts, and Turkey cannot be depended upon for much assistance.

The German armies in the field must be kept at five millions, or some part of the line goes down. An estimate of a five per cent. monthly wastage, which is conservative, means that, in order to keep her armies up to their present strength, Germany must feed into them a quarter of a million men monthly. Therefore, if the Allies can hold on until next May the German armies will fall below the five million mark, and below that mark they cannot hold their lines. The result is obvious.

[Note. *N. Y. Times*, July 29, '17. Quoted.]

At the end of the third year of the war the sources are multiplying which tend to show that Germany's man-power is on the wane.

Thousands of her conscripts of the class of 1918 have been captured on the western front. Of the total enlistments of 13,130,000 men, including the class of 1918, there remain, according to deductions made from German official reports, 8,606,693. The balance on June 1 had been disposed of as follows:

Killed or died of wounds	1,032,800
Died of illness	72,960
Prisoners	591,966
Wounded	2,825,581

The German casualties of the same sort a year ago amounted to 2,935,177. She therefore lost in the first ten months of the third year of the war 1,588,130. Of the 8,606,693 there remain on active service or in reserve between the ages of 17 and 45 5,435,000. To these may only be added in the coming year the conscripts of the class of 1919, numbering 450,000, making a total of 5,885,000 effectives.

This is the real army with which the millions of the Allies have to contend, for without it the Austrians, unless fighting from mountains, or the Bulgars and Turks, without its discipline, would amount to little.

Germany

[The German War Losses. Quoted from various publications. *Memorial de Artilleria*, Dec, '16. 260 words.]

EUROPEAN WAR—Continued

The *France Militaire* publishes some data taken from the German official lists of losses, from which we take the following:

Total losses, army and navy, from the beginning of the war to the month of October, as published:

Killed	922,272
Wounded	2,351,011
Missing	499,938
Total	3,773,221

The losses of officers included in the above are:

Killed	28,277
Wounded	55,187
Missing	5,220
Captured	2,855
Total	91,539

The French publication above mentioned in a comment, states that the above losses are very much inferior to the actual losses.

The total number of German casualties reported in official German lists to the end of January, 1917, is 4,087,692 as follows: Killed and died of wounds, 929,116; died of sickness, 59,213; prisoners, 247,991; missing, 276,278; severely wounded, 539,655; wounded, 299,907; slightly wounded, 1,512,271; wounded remaining with units, 223,261. The total casualties reported in January, 77,531.

[German Losses for November, 1916. *The Canadian Military Gazette,* Jan 9, '17. 150 words.]

German casualties reported in official German casualty lists during November, 1916, are as follows:

	In November	Total Reported
Killed and died of wounds	28,729	889,957
Died of sickness	1,625	56,070
Prisoners	1,472	214,739
Missing	30,678	285,041
Severely wounded	21,843	521,203
Wounded	6,551	293,170
Slightly wounded	62,667	1,453,870
Wounded, remaining with units	12,601	207,819
Totals	166,176	3,921,869

These figures include all German nationalities but do not include naval casualties or casualties of colonial troops.

[Results of British Offensives. *Sphere,* June 30, '17. Two diagrams.]

British offensives have resulted in the following captures.

Year.	Name.	Duration.	Prisoners.	Guns.	Mach. guns.
1915	Neuve Chapelle	7 days	2,000	..	..
"	Festubert	10 "	1,000	..	..
"	Loos	8 "	3,000	26	about 40
1916	Somme	102 "	32,000	125	650
"	Ancre	8 "	8,000		
1917	Vimy	8 "	14,000	..	..
"	Vimy-Arras	..	....	257	697

[Notes on the War. *Army & Navy Jour.,* July 28, '17. Quoted.]

The German casualties reported in the German official lists during June, but not as having occurred in June, were given out by the War Office in London, July 19, as follows: Killed or died of wounds, 28,819; died of illness, 3215; prisoners and missing, 38,606, wounded, 95,906. The totals of the German official lists since the war began are as follows: Killed or died of wounds, 1,032,800; died of illness, 72,960; prisoners and missing, 591,966; wounded 2,825,581. The naval and colonial casualties are not included.

[4,500,000 German Casualties. *Army & Navy Gazette,* July 26, '17. 100 words. Table.]

Casualties announced in German official lists, reported but not necessarily incurred in June, are as follows:

	June.	Total.
Killed and died of wounds	28,819	1,032,800
Died of sickness	3,215	72,960
Prisoners	1,835	316,506
Missing	36,772	275,460
Severely wounded	21,315	590,889
Wounded	5,354	315,233
Slightly wounded	56,160	1,655,685
Wounded, remaining with units	13,547	263,774
	166,077	4,523,307

Great Britain

[Notes of the European War. *Army & Navy Jour.,* Nov 4, '16. 100 words.]

British casualties reported for October in all areas were officers, 4331; men, 102,702. The daily average loss was 3542. The losses have been decreasing since August.

[Note. *Army & Navy Jour.,* Jan 20, '17. 150 words.]

Casualty lists published by the War Office show that the total losses among British army officers from the beginning of the war to Dec 1, 1916, amount to 53,122, of whom 15,696 have been killed or died of wounds, 33,970 have been wounded and 3456 are missing. A large proportion of the wounded have since returned to duty.

All Canadian casualties to Dec 1, 1916, amount to 68,290.

[Note *Army & Navy Jour.,* May 10, '17. 80 words.]

According to an official statement of Feb 28, British casualties during February reached a total of 1243 officers and 17,185 men.

[Notes On the War. *Army & Navy Jour.,* Aug 4, '17. 50 words.]

British casualties in all theaters reported in the newspapers during July aggregate 2503 officers and 69,329 men killed, wounded, or missing.

[British casualties. *Canadian Military Gazette,* Oct 9, '17. 30 words.]

British casualties for September totaled 104,598, divided as follows: Officers killed or died of wounds, 636; men, 18,302. Officers wounded or missing, 2151; men, 83,509.

[British Dead in France under 7 Per Cent. *Official Bulletin*, Nov 12, '17. 500 words.]

The Secretary of War announces that up to June 1 the losses of the British Forces in France in deaths in action and deaths from wounds were about 7 per cent of the total of all the men sent to France during the war. The losses to-day because of improved tactics and allied superiority in artillery is less than seven per cent.

—Losses—Aeronautical

[Note. *Army & Navy Jour.*, May 12, '17. 60 words. Quoted.]

A compilation from British, French and German official communiqués, made in London on May 2, shows that 717 airplanes were shot down on the western front during April. The Germans lost 369, the French and Belgians 201, and the British 147. This is a great increase over the casualties for any similar period. The highest previous total was 322 during last September.

[German *vs.* British Aerial Activity. *Scientific American*, Nov 3, '17. 180 words.]

The British officially announce that during September British bombing machines made 226 raids, dropping 7886 bombs, representing 135 tons of explosives, whereas in the same period the Germans dropped about 1000 bombs on the British. Also, during the same month the British made 7964 "shoots" with artillery at enemy batteries under aerial observation, and silenced them in 1813 instances; whereas in the same period the Germans succeeded in ranging on only 743 British guns. During September British airmen engaged and brought down 274 enemy planes. This is a conservative number, for an airman never gets credit for a victory unless the fall of an enemy is corroborated from either an observer on the ground or another airman in the vicinity.

—Losses—Sanitary Service

[Note. *Army & Navy Jour.*, July 21, '17. 250 words.]

Anent the reports that 60,000 medical officers have been killed and that as many as several hundred have been killed in a single engagement, Col. T. H. Goodwin of the R. A. M. C., who has been in this country since the visit of the British Commission, cabled the British War Office for the facts and received the following data: The total casualties among British medical officers on the western front from the beginning of the war to June 23 were 195 killed, 707 wounded, and 62 died of disease. It is known that there are 12,000 doctors in the entire British army.

—Machine Guns in

See

MACHINE GUNS—USE OF IN EUROPEAN WAR

—Military Lessons of the

See also

PATROLS—IN TRENCH WARFARE

TACTICS—OFFENSIVE VS. DEFENSIVE

[Military Lessons of the Present War in Europe. By Jikyu Hirayama, Major of Infantry, Japanese Army. *Kaikosha Kiji*, May, '16. 2000 words and many headings and sub-headings.]

(Two main headings as follows: (1) Concerning Strategy and Tactics, Organization, Railroads, Communications; (2) Strength to supplement the troop numbers, fortress material.)

(Tactics and Strategy are discussed under ten heads, starting with the strategy of the interior lines and the strategy of the exterior lines. With the development of the machinery for communication the command of the exterior lines has become much easier in modern wars, but this general control of the respective armies differs with the strength of the several armies of the combination. The German-Austrian allies used with great advantage their highly developed railroads in the first part of the war on the eastern front.

Enveloping attacks and breaking the center are discussed in another chapter. This discussion is a general one and brings out no new ideas.

The merit of military operations depends on speed. This feature is discussed at length, and the writer lays great stress on the need for speed in modern army operations. The great speed of the marching German armies enabled them to press the French back on Paris. The point of decisive attack should be selected where we can concentrate our greatest force and if possible where the enemy is the weakest.

In the second part of the article the peace organization of armies, the ability to augment same, railroads, communications, etc., are discussed, and various examples and lessons drawn from the present war in Europe are cited.)

[Complete Change in Modern Warfare. By a British Army Expert. *Forum*, Nov, '16. 5000 words.]

With immense armies operating in a restricted area, trench warfare will necessarily result. In this class of warfare, certain new conditions are introduced.

1. Musketry is no longer as important as formerly. Sniping by picked shots is more important, but rifle fire by the rank and file has its former value only when an assault is to be met. In this case the range is so short that nerve and coolness are more important than skilled marksmanship.
2. Artillery has become paramount.
3. Bombing and mining are of great importance.
4. There is so little opportunity for the use of cavalry that the most practical policy is to turn it temporarily into infantry.

Both in control of direction and in intensity, gunnery has advanced so that an assault is impossible without artillery superiority. Whether trench warfare is permanent or temporary, the dominance of artillery will continue.

Discipline is either the discipline of coercion, which impresses the rank and file with the relentless power

EUROPEAN WAR—Continued

over them, or the discipline of habit. In the one, the men fear their officers, in the other there is respect and devotion. Only in the discipline of habit is the initiative of the men fully retained, and this quality is more important in the loose tactical control resulting from the intensity of modern artillery fire.

The essentials of training for modern warfare are:

1. Discipline.
2. Musketry.
3. Trench digging, especially at night.
4. Physical.

Discipline is the backbone of military organization. Fire superiority is decisive, and can be insured only by careful training in the use of the rifle. There are many details to be taught, and they require time.

An assault is carried out by three lines. The first carries grenades and cutting tools, possibly also planks to cross obstacles and trenches. The second line is similiarly equipped, and replaces the first line when necessary. The third line follows to nullify counter-attacks or to push on and occupy the second line. Bombing squads accompany each line. In a captured trench they have three duties—bombing the dugouts, extending the lodgment laterally, and working down the communication trenches.

Lateral extension is best accomplished by teams of bombers and bayonet men. They move along the trenches until the enemy is encountered. Bombs are then thrown over the heads of the bayonet men into the trench occupied by the enemy, probably beyond a second traverse. Then the bayonet men rush ahead and dispose of the enemy. This process is repeated.

In the attack on Verdun, the Germans used 16½ battalions and a pioneer company. The use of gas had been intended but the wind was unfavorable for several days and the cylinders were removed two days before the assault. For a fortnight the French front and the ground in rear were heavily bombarded. On the day of the attack an intense bombardment was carried on for eight hours. According to a captured order, there were to have been two intermissions of 10 minutes each, but these were omitted when it was decided not to use gas. The formation for attack was line of battalions, three companies of each in the front line and one in support. The assault was made by companies in successive waves.

During the bombardment, the companies which were to assault were in the first-line trenches, the supports in the second-line trenches. In the actual assault, a few pioneers preceded the first wave carrying grenades. They were to clear a passage but the entanglements had been completely destroyed by the bombardment. Machine guns were carried forward to the new positions as soon as the last wave had attacked. The attack resulted in the occupation of the French front line. On the following day an assault by three fresh battalions extended the lodgment to the south. There followed confused grenade fighting and an intense bombardment by the French which prevented organization of the captured ground, and the trenches were recaptured little by little.

Germany foresaw most things in the way of preparation for war, but failed to foresee that England would be driven into the alliance against her. After the Marne came the chief surprise of the war, the digging-in from the sea to Switzerland. That accomplished, the normal fighting is bombing and mining, in which the losses are continuous and heavy, but otherwise the operations produce little result. Both sides vary the monotony by making attacks along fronts of several miles, for which a large concentration of men and guns must be made, secretly if possible. Aeroplanes and the necessity for a preparatory bombardment make surprise difficult. These attacks are attended by heavy losses. (Follows a discussion of the arithmetic of war.—Ed.)

The Allies have attained supremacy in the air, but this ascendancy was not attained nor is it maintained without losses.

The British have become adept in night raiding. Parties creep out, rush the wire, shoot and stab the sentries, bomb the dugouts, destroy machine guns and trench mortars and then retire. Brief references to "mining activity" cover the dangerous and trying underground work of the engineers. Before a mine is exploded many guns are trained upon the spot. Often the crater is seized by infantry.

In the Verdun sector, the Germans almost overwhelmed the defense by devastating artillery fire and torrents of assaulting infantry. The French lines could not be denuded but the need for reinforcements was supplied by the British taking over the Souchy-Carency-Arras line, thus supplying the needed reserves. The battered wreck of Arras bears mute testimony to the valor of the French. The British lines, once short and thinly held, are now greatly lengthened and securely held with the backing of a large reserve.

[Man-Power and Munitionment. By Hilaire Belloc. *Land and Water*, Dec 7, '16. 6000 words.]

The campaign in Europe is governed by two sets of elements, the one uncertain, the other certain.

The uncertain elements are moral factors, such as, the political relations between belligerents and neutrals, and the element of time.

The certain elements are the *numbers* of men and women available for the war, and its support for the various belligerents; and the material available. It is upon these alone that useful debate and analysis can turn. For eighteen months statistics as to the enemy man-power have been analyzed at regular intervals and with increasing accuracy.

In March, 1915, the margin of error in the calculation of the German military dead was about 30 per cent. To-day this error is about 5 per cent. Thus the statement that 1,500,000 German soldiers have died since the beginning of the war (up to Oct 25, '16) is not more than 75,000 wrong one way or the other. The reason of this increasing accuracy is that time accumulates not only the mass of the evidence, but the power of co-ordinating that mass and at the same time the methods of obtaining information. But the campaign does not turn upon man-power alone. It turns also upon equipment and munitionment.

Within the last few years the power to produce military equipment and munitions has ceased to be common to all civilized men: it has become peculiar to certain highly industrialized spots, and even among these it varies greatly.

The example of the field piece is typical of the increase of complexity in the development of armament. In contrast with it the piece in use 50 years ago belongs to another age instead of to another generation. The construction of modern armament demands the co-operation of a hundred processes each dependent upon the most highly skilled labor of a type quite unavailable to simple social conditions. Not only therefore is the problem of munitionment a problem of getting very expensive and very complicated machinery produced, but also the problem of getting it produced for forces hitherto undreamed of. Waterloo was fought by less than a quarter of a million men, all told, and decided in eight hours.

The Marne—to consider only an action of movement—took a week to decide and involved the actual combatant action of 2,000,000 armed men.

The advent of trench warfare has proved by experience that the rate of production of material must now exceed by 200 times the rate allowed for in calculations made before the war.

The three factors present in the production of modern equipment and munitionment which must be considered separately in gauging the chances of the belligerents for the future are: First, raw materials, notably coal and iron. Second, the general labor available for working up the raw material. Third, the highly skilled specialized labor without which the whole process halts. In the first and last of these three factors the Teutons will not fail. It is in the middle factor, general labor, that the strain is already being felt and that the advantage of the Allies will appear.

The superiority of the Allies in recruiting power has always been evident. In the other factor necessary to success, that of equipment and munitionment, an analysis reaches much the same result as to the superiority of the Allies.

The conclusion is that there remain as possibly adverse no factors save those political or moral ones which are not susceptible of calculation.

[Lessons in Tactics and Strategy Obtainable from the Great War in Europe. By Lieut.-General Tanaka. *Kaikosha Kiji*, Dec, '16. 1500 words.]

1. The fundamentals of tactics and strategy have not undergone any great change. The present war in Europe is in magnitude incomparably greater than anything before known in the world, extending to the Balkans and into Asia. The amount of material used has been tremendous as also has been the number of troops. But no decision has yet been reached. Judging from the number of troops employed and the amount of material used, the Russo-Japanese war cannot be spoken of even in the same breath; but as for results and tactics and strategy there has been no great advance in general principles.

2. The necessity of offensive operations. This is a point that no one denies. In each of the coutries concerned, the great policy for defense of this country was the offensive. For example, the great offensive of the French in Alsace was intended to counteract the German destructive invasion of Belgium and to try to strike the center of the German army that was crossing the Marne. Again the most essential thing to force the enemy to yield to our ideas, and so to obtain the greatest advantage ourselves, is the offensive. The offensive also raises the morale of the men and often puts the field of military operations into the enemy country. It goes without saying that our [Japanese] military policy is the offensive, because of the characteristics of our race and of the type of our soldiers. This is a point that our [Japanese] young officers must bear in mind.

[Experiences of the Present War. Compiled by Major Pedro Obregón, Spanish Military Attaché to Austria-Hungary. From the *Tactical Manual* of Gen. Hugo Smid, Austrian Army, *La Guerra y Su Preparación*, Jan, '17. 1025 words.]

Combat (General)

All officers must take cover during combat. It should not be possible to distinguish officers of higher (all) grades from the subalterns.

Orders must be clear and precise.

Save ammunition.

Watch carefully for surprise in inhabited places.

Protect visual signalling from enemy's observation.

The enemy attempts deceit by using white flags and also our uniform. Therefore do not cease firing until he has thrown down his arms.

Keep up the service of security during marches and halts.

Infantry

Combat reconnaissance: First by patrols; if the enemy is in position then by thin skirmish lines with 10-pace intervals between skirmishers.

Patrols should cover carefully enemy's position, terrain, roads and bridges and make immediate report.

Movement within the enemy's artillery fire: Very thin lines with distances of 500 or 600 paces.

Attack: Advance with thin skirmish lines and only after thoro reconnaissance.

Flank positions: Situated in front of and to the side of the frontal positions must, like the weaker advanced positions, be thoroly reconnoitered before attacked. To take them they should be flanked whenever possible.

Advanced units must intrench.

Advance slowly.

Reserves: Advance in small groups and in thin lines. Thick firing line only just before assault.

Continue flank protection, even after taking enemy's position.

Defense: Deep trenches (standing). Should be placed on the slope towards the enemy and hidden from him. Each man should have a spade. (Long handles preferable.) Officers and non-commissioned officers should be trained in handling explosives.

EUROPEAN WAR—Continued

Combat in woods: Watch each tree; it may hide a sharpshooter or even a machine gun. Preserve absolute silence. Shrapnel should burst high. This will help clear out enemy's posts in the trees.

Defense against cavalry attacks: Open fire at 800 yards.

Retirement: Orderly and in small groups. Protect flanks.

Machine Guns

These should enter into positions quickly and should entrench. Positions should also be marked. Each man should carry a spade. Flanks are very vulnerable. Retirement, when necessary, should be effected piece by piece.

Choice of position: Avoid buildings and corners of woods. Pieces should be at least 50 paces apart and not at the same elevation. Ammunition point at least 1000 paces in rear. Constant inter-communication must be kept up.

Tactical employment: Advance by rushes, taking every advantage of favorable terrain. Possessing great efficiency and accuracy of fire, machine guns must always be on the alert both to the front and flanks. Where a field of fire is not to be had (and sometimes at night) the guns should be with reserve.

Cavalry

Horses should be hardened to campaign. Few quick movements; longer and slower ones. For the horseman, instruction in the use of the rifle is of prime importance. He should also be trained to fight on foot and in trench warfare. Charges are without importance. In pursuing the enemy's cavalry watch for surprise fire. The lance has at times given good results.

Artillery and Engineers

Careful preparation and skillful use of terrain. Concentric fire wherever possible.

Field howitzers: In spite of their short range these can often be used against hostile trenches. Poor observation and premature opening of fire often wound our own troops. This should be avoided at all costs.

Shrapnel bursts are often too high.

Targets and effect of fire should be carefully observed by trained observers well to the front. Posts too far to the rear are useless.

Church towers draw the enemy's fire.

Hostile artillery positions can be discovered only by skillful patrolling or by airplanes.

(The author notes that the Russian heavy artillery has been very successful against hostile infantry at a range of 10 kilometers, and the light field piece at 6 kilometers.)

[The Annual Report to the Royal Academy of the Science of War on War Administration, Transport, and Medical Department. *Krigsvetenskaps-Akademiens Handlingar och Tidskrift,* Feb and Mar, '17.]

The Art of War under the headings:

1. The relations between the position warfare and field operations.
2. The characteristics of position warfare.
3. Organization—(*a*) Time necessary to train men. (*b*) System of replacing losses. (*c*) The infantry. (*d*) The Cavalry. (*e*) The artillery. (*f*) The air service.
4. The system of attack in position warfare employed on the western front.
5. The more important attempts to break thru the enemy's lines during 1915-16 of the present world war.
6. Report on artillery.
7. Gymnastics in the training of soldiers.
8. Training in measuring and estimating distance.

[Superior Power at the Decisive Point. By "Rooinek." *United Service Magazine,* Mar, '17. 3000 words.]

Mr. Churchill and his school have argued as follows: Concentrate against the weaker links of the enemy's chain, i. e., cut him off in the Balkans, a more complete blockade of Germany, place Russia in closer touch with the Allies, win over the Balkan states. In other words, it was to be a short cut to victory or something for nothing. The Dardanelles fiasco is a complete example of dissipating our forces and matériel in the far corners of the earth over long lines of communications.

But across the west front lie the vitals of the enemy as distinguished from his weak points. Here our fighting army is close to home and operating in a friendly and civilized land. Communications are short and secure for the movement of troops, supplys, matériel, and wounded. We are indirectly defending the British islands, and in case of an attack at home troops can be easily brought back from France. To win the war it is necessary to overcome the chief armies of the principal enemy. The Germans realize that, and it is a hard task for us, for they have 120 divisions on the west front.

German war theories have not been proven wrong in this struggle. They themselves failed only because they did not adhere strictly enough to them in their initial drive into France. Had they abandoned East Prussia temporarily as per program, the battle of the Marne would have been a different story.

The Germans are too good soldiers not to know that the decisive field lies in France. And if the Allies break thru in the west, Germany's cause is irretrievably lost.

[General Kuhn on European War. *Army & Navy Jour.,* Mar 17, '17. 1000 words.]

General Kuhn, recent American military attaché at Berlin, comments that 37,000,000 men are arrayed along 2000 miles of battle line in Europe, with an average of 5000 men lost each day. He says that the three most conspicuous lessons of the war on land relate to aviation, artillery, and machine guns. To enable the aviation service to carry out its function of observation, including control of artillery fire, there has taken place a gradual specialization of duties resulting in well defined types of machines of which three are now well established, viz., the fighting scout machine, the artillery fire control machine, and

the general reconnaissance and bombing machine. All are equipped with machine guns for both offensive and defensive purposes. All nations agree that the fighting scout machine must be very fast, a rapid climber and quick at maneuvering. In Europe the railroads, good wagon roads and motor trucks have so well solved the problem of transportation that the expenditure of ammunition is limited only by the ability to manufacture it. Altho shrapnel is still unquestionably best against personnel, three-fourths of the ammunition used is high explosive shell because it is necessary to pulverize the strong field works and obstacles in preparation for an infantry advance.

Whereas at the beginning of the war the Germans had one machine gun company of six guns for each regiment of 3000 men, to-day they have three and probably more.

General Kuhn states that it is certain that the German people are on the edge of starvation.

[Foreign Military Technical Novelties. By V. Kaiserov. *Voenny Sbornik,* Apr, '17. 4500 words. Illustrated.]

Austrian D. F. W. Biplane.—Austrian airplanes are, in general, close copies of German machines, and their so-called Loner biplane is in a reality substantially the German D. F. W. machine with minor changes. This biplane has a single fuselage; wings 13.6 meters long; a total length of 8.6 meters; and a six-cylinder motor of 145 horsepower. The radiator is situated on top, as in the majority of new German airplanes.

Doiotta Airplane.— This is an exceptionally light monoplane, weighing empty only 500 pounds. Wings are 29 feet long; lenth is 22½ feet, and height 8 feet. The speed is variable from 45 to 65 miles per hour. The motor used is a 50 h.p. Gnome.

Austrian Hydroplane.—A two-seated biplane, using a 170 h.p. Mercedes engine. The radiator is placed forward and above the engine. The propeller is in rear and can turn in both directions. The oil and gasoline tanks are located in the fuselage.

Aero Cruiser.—This is the well-known Curtiss triplane "America," a lengthy description of which is omitted, as this machine is probably well known to our readers.

A New Curtiss Airplane.—A new biplane, very small, and with exceedingly short lower plane. The entire length of the fuselage is 20 feet. The speed is about 110 miles per hour.

The British Tank.—This is an armored enclosed caterpillar, the method of locomotion being the movement of one endless belt on each side, revolving around motor wheels, along the ground. The belts turn in either direction and independently of each other. If one belt is revolved forward and the other backward, the tank will describe a circle about its own center, the center remaining stationary. The tanks are equipped with a ram, inclined upwards from 30-40 degrees, enabling fences, entanglements, walls, etc., to be thrown over. The motors used vary from 120 to 150 h.p. The speed obtained is 4 to 4½ miles per hour. Height is about 2 meters, and length over all about 10 meters. Weight about 7 tons. Periscopes are provided for the use of the tank commander, each gun or machine gun crew and for the chauffeur. Armor protection is furnished which is proof against rifle, machine gun and shrapnel fire. A tank carries some combination of machine guns and small caliber (37 cm.) cannon. The arrangement is such that the "bow" fire is four guns, while the "broadside" fire is three guns.

Benzine Locomotives.—These locomotives are for use on narrow gauge field railroads. Their weight is about 7 tons; gauge, 75 cm. Engines are four-cylinder, four-cycle motors, designed to give a speed of from 4 to 8 miles an hour, on benzine of specific gravity of .770. Some 350 of these engines have been recently furnished by an American firm for use in Europe.

Armored Railroad Car.—A car designed by the U. S. Navy for use in Mexico, and having three compartments, the center one having a field gun, while the end compartments carry machine guns firing thru embrasures either to the front or towards the sides. The field gun has all-round fire, with angles of elevation of from +15° to —5°.

Mechanical Armored Car.—This is an armored automobile, fitted with machine guns and with flanged wheels for use on railroads.

Electrical Rifle Sight.—A device for attachment to a rifle to enable an instructor to determine where the holder of the rifle is sighting. The device, which is attached to the barrel of a rifle near the muzzle, contains a small lamp enclosed in a tube. The lamp throws a ray of light on the point aimed at.

Superperiscope.—A periscope having a telescopic tube which can be raised to a height of about 40 feet, thereby greatly enlarging the field of view, while affording complete safety from hostile artillery fire.

Portable Trench Gun.—This is a 16-pound muzzle-loading gun, with a pointed breech end for sticking in the ground. It is intended for use by one or more men who can quickly set up the gun, fire a few shots, and then move rapidly to some other point.

[The Transformation of War. By Hilaire Belloc. *Land and Water,* June 28, '17. 3000 words.]

The most novel condition produced by this war—and the one most ominous for the future—is the conviction by experience that even the modern complex nation fully armed can continue an intensive struggle for a very long time indeed.

The next novel condition should be carefully noted, and is only second both in importance and in unexpectedness. It is the fact that the modern European makes of nationality a sort of religious feeling, something more sacred than any other motive.

Even the great issue between capitalism and the proletariat in industrialized countries, which it was thought would cut across the sentiment of nationality, has proved insignificant compared with patriotism. It is therefore certain that war upon so enormous a scale has proved more possible and its *continuance* more possible than was expected.

EUROPEAN WAR—Continued

Referring to the technical side of the matter, it is found that the military art has been compelled by experience to new decisions. These may roughly be classed in three fields.

First there are the novelties due to the scale upon which the struggle has developed: as, for instance, siege lines of a thousand miles.

Secondly, there are the novelties due to the unexpected excesses of the Germans and their abandonment of our common morals; as, for instance, the absence of neutral territory defining a field of war, and the added strain on medical services.

Thirdly, there are the novelties due to the unexpected effects of new weapons and new inventions; as, for instance, and in particular, air-craft.

Some of the differences of quality between this and former wars are:

(1) The rapidly rising proportion of heavy artillery, which was in no way foreseen.

(2) The necessity for the munitionment of heavy guns in so enormous a fashion as utterly to disturb the calculated relations between civilian necessities and military necessities.

(3) The lengthy process of siege warfare, multiplied by its severity, has necessitated the relief of units from action, their reorganization, and their replacement at a rate never before dreamed of.

The existence of a siege upon so gigantic a scale has transformed the civilian population behind the army into a population of workers supplying the army. The war will be won by the group which can wear down the other.

[Strategical Higher Direction in the Present War. By Maj. T. E. Compton. *United Service Mag.*, Aug, '17. 2700 words.]

Germany has enjoyed many advantages over her opponents in the present war; political, geographical, and military. Among the latter her system of higher direction is one of the greatest. This system has been the model to which the various systems of the Entente Powers gradually have had to be approximated.

The German constitution, so framed as to leave all the real power in the hands of the Emperor, is especially adapted for war and for the preparation for war. The German system of higher direction is based on the principle of the division of staff duties into two branches: *Operations* and *Administration*. The first of these two branches has control of everything relating to military education and training, and the preparation and execution of plans of campaign, leaving the business part of the army to the administrative branch. Each branch has its own responsible head, the chief of the Great General Staff and the War Minister respectively.

The Chief of the General Staff is principal military adviser to the Emperor. As the latter has all the power of the state in his hands, the Chief of Staff is practically a dictator with regard to everything relating to war as long as he enjoys the confidence of his ruler. Given capacity, the advantage of a military dictatorship is obvious. This advantage is one that must remain with Germany as no democracy can possibly attain to it. The constitution of the United States is better adapted to the waging of a great war than that of either France or England, on account of the greater executive power given the President. The essence of the German Higher Direction lies in making one man responsible and in giving him power commensurate with his responsibility.

After many initial blunders, both France and Great Britain have approximated, as closely as is possible in a European democracy, to the simplicity and effectiveness of the German method. Each has a War Council in supreme control. A civilian is War Minister and the Chief of the General Staff, the responsible strategist, advises the War Council of the Cabinet, as Hindenburg advises Wilhelm II.

Geographically, Germany has the advantage of the central position and the consequent interior lines, greatly facilitating the economical employment of force at decisive points. This fact must continue to remain distinctly in her favor.

There is another reason, a political one, why the advantage in unity of direction must rest with the Germans. The great Entente Powers are all of practically equal standing and in no way subservient to each other. On the other hand Germany dominates her allies absolutely, and her Staff can make their plans so as to utilize to the utmost the strength of the combined Central Powers, without consulting the wishes of any one.

—Military Situation

See also

EUROPEAN WAR—CONDITION OF BELLIGERENTS
EUROPEAN WAR—PEACE NEGOTIATIONS

[Another Problem in Strategy. By Colonel Feyler. *Land and Water*, Sept 7, '16. 1400 words.]

It is interesting to examine the theories of General von Bernhardi, with a view to seeing how accurately they reflected the views of those who controlled the strategy of the present war.

Von Bernhardi says that victory consists in crushing the adversary, and that victory results from mobility and numbers. Mobility permits concentrations which give numerical superiority at decisive points. Comparing the positions of Germany, France, Russia and Great Britain, Germany and France would at the start be approximately equal with France deficient in reserves; Russia has great numerical superiority, partly neutralized by the necessity of forces to preserve order at home and to watch the eastern and southeastern frontiers, in addition to which her population would be lacking in enthusiasm, but still 2,000,000 men would be available; months would pass before Great Britain could increase her forces beyond the 150,000 in the regular army, of which part must be left in the colonies, so British troops could only serve as auxiliaries; and the sea warfare would be secondary to land warfare, hence the war would be decided by a crushing victory on land.

The above premises form the basis for the Austro-German plan. Naval inferiority was to be nullified

by a victory on land to be achieved by rapid blows, backed by preparations for durable resistance in case of failure. To accomplish all this, every effort was made to obtain superior mobility. Such are roughly the fundamental principles of Bernhardi's teaching, and they were followed in all recent German military reforms.

The general plan of campaign followed these fundamental principles. An attempt was made to crush France, but this attempt failed. It was not believed that Great Britain could supply the deficiency in French reserves, but Great Britain has had time to prepare a land army that now occupies a considerable part of the front and has ample reserves. After France was crushed, the forces were to be turned against Russia, whose offensive would collapse thru lack of national enthusiasm. After the failure of the attempt to crush France, the German forces were turned against Russia and the Russian offensive was repulsed, but the Russian morale was not broken. Russia was assisted by Japan, and no forces were unmobilized on the eastern frontier. And finally, German success on land has not been sufficient to create the slightest impression upon British command of the sea.

For years Germany prepared an army whose superior mobility was to compensate for enemy superiority in numbers, but the carefully prepared army obtained no decision. The German leaders must have been the first to realize the failure of the offensive plan and that the program of conquest would have to be replaced by the scheme of durable resistance, but not without a last great effort. Operations against Russia did promise sufficiently rapid results. To crush France and, thru France, Great Britain offered more favorable prospects. The plan which failed in 1914 was resumed with a vigor to astound the world. It was resolved to storm the fortress of Verdun.

[Aspect of Operations After Two Years of War. *Memorial de Caballeria,* Sept, '16. 1800 words.]

Germany is unable to advance on the French front. The Allies have twice tried to break the German line. In Champagne the effort was costly and useless. The months pass and the invaders continue to hold their ground. In Picardy, the small changes which the maps show fail to compensate for the loss in men. Russia, assisted by the Machiavellian intervention of Rumania, has been able to reconquer some hundreds of square kilometers. Italy has been able to take Gorizia. Near Salonika the Bulgarians have taken the offensive. A half million of British soldiers remain inactive in Egypt. The operations in the Caucusus and in Persia do not merit much attention at present. Japan is as tho she did not exist. The Serbians, after reorganization in Corfu, are now fighting in the first line at Salonika. The Anglo-French are not accomplishing much, either on the Somme front or at Verdun.

Germany has lost the initiative on both fronts. On the western front, she has lost a small portion of ground, on the east a good deal more.

Austria has had to fall back in Galicia, Poland and Bukovina. The Italian invasion by Austria has been stopped. Turkey has lost the vast extension of Armenia. France and England have failed to respond to the hopes of their adherents.

Russia, which has performed an extraordinary military, material, and moral labor, fights only on two fronts, one of them secondary. Nearly all of the Italian army and fleet are thrown against Austria, but so far without the results which should be expected against an enemy so situated. Turkey contains the Russians towards Armenia, has almost expelled the English from Mesopotamia and disquiets them in Egypt. She also sends troops to other fronts. Good work for this valiant people who, directed by masters of the art of war, shows proofs of vitality which merit existence as a European nation. The war continues on land, in the air, on the sea and under the sea and there is no end in sight.

[The Strategical Situation in Europe Compared with That of the Seven Years' War. By Maj. T. E. Compton. *United Service Magazine,* Oct, '16. 2400 words.]

The situation, now and then, differs of course in many ways, but mainly in three particulars: (a) England's sea power is now opposed to Germany; and altho, as a compensation, Austria is now her ally, yet the whole man-power of the British Empire, which has at length been thrown into the balance, weighs heavily against this advantage. But the adhesion of Austria, Bulgaria and Turkey to Prussia has had this effect, that (b) Russia has been for many months until Rumania joined them, effectively separated from the rest of the Allies in Europe, which has been inconvenient, especially in winter when the port of Archangel is closed; but Japan, on the other hand, has become, thanks originally to the English alliance, a most important supply of matériel of war to her late antagonist, by way of Port Arthur. (c) The third point of difference between the present situation and that of the Seven Years' War, is the immensely increased numbers, out of all proportion with the armies of those days and beyond the conception of their leaders: the appalling modern system of the nation in arms. What is especially appalling about it is not so much the immense destruction of all the sources of wealth and material prosperity, the waste of energy, or even the loss of life as a whole, but the quality in the latter loss. Brilliantly endowed men and youths engaged in, or intended for scientific, parliamentary and literary pursuits, many of whom had already given promise of careers of usefulness and inspiration for the benefit of mankind—perhaps even more than one great poet—have been swept into the vortex and have perished with their powers all but untried.

The all-important difference between the present great struggle and that of the eighteenth century is that whereas then the wealth of England kept Frederick in the field, while her fleet kept open her ports, today the situation is reversed. William II and his Germans, having for years flouted and estranged, by every possible device, English sympathy and opinion, are now feeling the pinch of a British blockade, while it is the financial support of England that has brought

EUROPEAN WAR—Continued

about the military resurrection of Russia after the disastrous campaign of 1915. On both sides, East and West, against the weakening forces of the Kaiser, masses of fresh troops, the mighty reserves of Russia and the British Empire, are forming in gigantic organizations, fully equipped and with abundant ammunition, for simultaneous attack and final victory.

[Opposing Strategies. By Col. Feyler. *Land and Water,* Oct 12, '16. 2000 words.]

(The strategy of envelopment and the strategy of interior lines are contrasted.)

The present campaign of 1916 once more places these two strategies in the limelight. The Allies are attacking in an endeavor to envelop, whilst the Germans and Austrians are defending themselves on interior lines. The result of the Allied strategy can be called "The Battle of Europe," for never before has so enormous a front been seen. This front, including the few zones of interruption, extends from 5500 to 6200 miles, or nearly a quarter of the circumference of the globe. The question is, how the two adversaries are to continue each his strategy in order to obtain the most advantage to himself? As for the Allies, the answer is simple. The attack must be as general as possible on the whole circumference of battle in order to oblige the Germans to counter at all points, which they can do only by using up their reserves. So many of these, however, are absorbed by far distant defensive operations that sufficient are not left to form an army strong enough to make a prolonged counter-offensive at any one point. If the Austrian reserves are held in the Alps, and the Turkish and Bulgarian reserves in the Balkans and in Armenia, then only German reserves remain to save the situation in Galicia. The object of the converging Allied attacks may therefore be seen.

As for the Germans, however, their situation can only be improved by a reduction of the front in order either to release men from the firing line for the purpose of constituting a new reserve, or to diminish the distance separating the reserves from the probable danger points. At this moment, the German eastern front from the Carpathians to Riga measures about 700 miles and the western front about 500. These two fronts are separated on an average by about 1000 miles. If during 1917 the Germans should decide to occupy the line from Cracow to Dantzig, 370 miles, and in the west the line from Basle to Wesel, about 310 miles, they would effect an economy of about 520 miles, which counting only one man to the yard of front, would give over 900,000 men to constitute a new reserve. At the same time the distance between the two fronts would be reduced by half, thus saving half the time necessary to transport troops from one front to the other. In this manner the maneuvers on interior lines would regain the elasticity at present lost by too extended a front and too great distances.

There is no doubt that the general *military* problem consists of neither more nor less than the above questions.

[1916—A Record of Twelve Months of Fighting. By E. F. *Sphere,* Jan 6, '17. 1500 words. Diagram.]

(This article contains a diagram showing by shaded portions the intensity and duration and giving the localities of the fighting on all the fronts. A month by month description of the fighting is given in brief form.—Ed.)

British Front. Intermittent fighting around Ypres from early in February to early in June. Battle of the Somme from the end of June to Nov 20.

French Front. Defense of Verdun from the latter part of February to the beginning of June with a lull in the latter part of April. Minor French counter-attacks at Verdun in August. Battle of the Somme from the end of June to early in November.

Italian Front. Austrian offensive from the middle of May to the end of June, succeeded by the Italian offensive of Goritzia and the Carso to the middle of November.

Russian Front (Europe). Gen. Evert's offensive near Lake Narotch from the middle of March to the beginning of May. Brussiloff's offensive from June 1 to early in December, resulting in the recapture of Lutsk and Dubno, capture of Cernovitz, conquering of Bukowina and general advance into Galicia continuing into September, when necessity of assisting Rumania halted his operations.

Russian Front (Asia). Erzerum captured in February, Bitlis and Trebizond campaign in March and April, and Erzingan captured in July. Fighting continued in this region until November.

Balkan Front. Austrian subjugation of Montenegro in January. Operations around Salonika from end of July to beginning of December. Capture of Monastir.

Mesopotamian Front. Siege and capture of Kut-el-Amara beginning of January to middle of May. British operations against Kut-el-Amara late in December.

Egyptian Front. Senussi, Sinai and Darfur operations middle of February to end of May. Fighting at Romani beginning of August. Capture of El Arish and operations in vicinity late in December.

Rumanian Front. Rumanian operations resulting in capture of Bucharest, and further German operations Sept 1 to end of December.

[War Notes. By Captain H. M. Johnstone, R. E. (retired). *United Service Magazine,* Feb, '17. 4000 words.]

It is not to be supposed that the work of attacking the German trenches has become easier and the success is not real as long as it costs too many lives. When the final and smashing stroke is inflicted upon the enemy, heavy losses can be afforded in doing it; but in local and partial affairs the men must be spared. The English have come to count on success in these now that their troops and those of the French have reached their present pitch of tactical skill, founded upon a certain preponderance of shell power. But the best success lies in the ability to force entrenchments with less loss to themselves than to the enemy. The

original method of strongly manned front line was given up by the Germans for one of few men and many machine guns as soon as the English gunfire was beginning to equal or surpass theirs; but it was soon found that the front line was being lost too quickly under such a system. Lately they have piled men in front, but this leads to more slaughter and more prisoners. The Germans can gain now only by being able to attack, and a despairing offensive somewhere on the west front may be looked for.

This project of a daring offensive on a large scale will be for the German command a counsel of despair, if it is to be on the west front. There is only the prospect of a futile slaughter of German soldiers at a stage of the war when the Central Powers are not in possession of troops they can afford to throw away. Their remaining hope is that they may be able to preserve their fronts unbroken until the destruction of Allied and neutral shipping by their submarines is sufficient to incline the Allies to put an end to the war by bargaining. Against this there stands the increasing lack of food in Germany and Austria. The leaders of the Central Powers have to reckon out whether their submarines or the British blockade are the more likely to finish their work first.

Observers in France believe that Germany contrived during 1916 to put together thirty new divisions, but that only a small number of these, six perhaps, really represent true creations. The rest were rather of the same kind as the subscriptions to the more recent German war loans. They were made up of units taken here and there from existing divisions, and mixed up with a very small proportion of newly trained men. Of course, the Germans have trained and sent out from the depots a far larger number of men than is to be found in six divisions, but five men out of every six have been required urgently to fill gaps in the battalions that have done the fighting. The personnel of the German artillery has suffered heavily, making a still more difficult gap to fill. Divisions have appeared three times on the Somme or the Ancre, that is, they have been twice drawn out to the rear after experiencing, in killed, wounded and prisoners, as much as half of their original effectives. Some calculations have it that the Somme and the Ancre have cost Germany 700,000 men, with Verdun from February to December costing half a million. Therefore, even without counting the wastage in Volhynia, Galicia and Rumania, the Germans have dropped at the hands of the French and British alone a mass of soldiers approximately equal to two years' supply of fresh men.

From Riga to the Pripet the Central Powers have no more than forty divisions of infantry, each division having thus as many as twelve miles of front to guard. This affords less than a bayonet a yard, which may be a fair provision during the winter, but will look very weak in May. South of the Pripet, however, the density of troops increases, and the number of Austro-German divisions down to the frontier of Moldavia exclusive is something over sixty. Leopold of Bavaria commands from Riga to the Dniester. There are groups of Armies—von Eichorn's in the north, then von Linsingen's in the center, and the group of Bohm-Ermölli in the south, that is, in Galicia as far as the Dniester. South of this river Archduke Joseph is in charge, his sphere extending to the west of Focsani, where his right is composed of the Army of von Gerok. This army is said to be quite a new one, recently interpolated for the purpose of hastening on the completion of the Rumanian campaign. It is composed of divisions which the Bulgars were looking for as a reinforcement in Macedonia. Then begins the command of von Mackensen, comprising three Armies—Ninth Army on the left, Army of the Danube between the Buzeu and Braila, and the Army of the Dobrudja, the first two of these being probably commanded by von Delmensingen and von Kosch respectively.

The Russian Staff estimate the hostile numbers on the east front at 140 divisions or thereabouts, with 24 divisions of cavalry. If there are 40 infantry divisions from Riga to the Pripet, and rather over 60 from the Pripet to the beginning of the Moldavian northern frontier, there remain over 35 engaged in the encircling of the Russo-Rumanians. The 24 cavalry divisions are extra to this, and may be taken as equivalent in numbers to 10 ordinary divisions. Three millions of troops can be thus accounted for on the long line from the Baltic to the Black Sea.

[The War on Land. *Army & Navy Gazette,* Feb 17, '17. 1800 words.]

But for Russian aid the Rumanians would have lost Moldavia. The Rumanian Prime Minister has acknowledged that his army has lost a large part of its effectives. The Rumanian troops are brave enough, but were simply outmatched in weapons and in numbers. Also over a dozen of their generals have been retired for incompetency.

It is estimated that Germany has six million men in the field. However, the extent of the fronts is now so great and the Allies' strength at all points is so formidable that the Germans can keep only 15 divisions out of 400 in general strategic reserve. This is a small reserve which a big push by any one of the four chief Allies might absorb, leaving other fronts with no reserve.

At one point in the British advance upon the village of Grandcourt they could not see the village owing to a sudden dip of the ground in front of them into the valley where the village squats. They have learned by experience that passing over the edge of a sudden change of slope like that is too difficult and must be postponed until the objective is taken in flank by another attack.

[Chronicle of the War. By A. *Memorial de Caballería,* Mar, '17. 5400 words. One sketch.]

(Continuation of the excellent description of the war by theaters which is published monthly in this journal.)

The résumé given of the general situation down to Mar 5 is as follows:

EUROPEAN WAR—Continued

With the submarine blockade the Central Powers have taken the initiative and now exercise a true offensive action, the effects of which are manifested not on sea but on land.

The Allies are suffering from this campaign to such an extent that they realize the immediate necessity of effecting a fundamental change in the situation. This may be accomplished only by launching a general offensive upon all fronts. But unity of action seems to terminate with the initiation of the attacks; each offensive appears to be diverted according to the particular interest of the ally making it. Without doubt one of the most important functions of the German higher command consists in devising means of preventing, or of breaking up, unity of thought and action on the part of the Allies.

Great and positive in war is the advantage derived from initiative, but strategy does not sanction this principle further than within the limit of activity of one group of armies or of one nation. Attacks once launched by the Entente Powers upon the three main fronts could not be broken off without incurring the risk of defeat and disaster. The Allies realize full well the fact that the Central Powers could contain them on two fronts and throw reserves upon the third front in such strength as to put that belligerent definitely out of the combat. On the other hand the Austro-Germans do not dare to attack, perhaps prematurely, in one of the theaters for fear of compromising their available strategic reserves.

It may be inferred from the above that the situation is rather obscure. Both groups of belligerents wish that a decisive battle could end the war, and both are afraid to start it. Will the Germans dare to risk the great advantage already gained upon the throw of a single card, and can the Allies venture to incur the danger of a decisive defeat?

[What Is the Decisive Point? By Lient.-Colonel A. J. Richardson. *United Service Magazine*, May, '17. 600 words.]

Loos, Verdun and the Somme prove that a partial offensive on a front of 20 miles, when the opposing lines are 500 miles, leaves such reserves free to act that it can get no decision. The gun, not the rifle, now dominates the battle field. Flying corps, infantry, engineers, tanks, all fighting troops, are but servants of the artillery, which explains the absence of routs. Artillery advances slowly, and to emplace it, to forward its ammunition, rearrange its telephone lines and its observation posts, and to register, require time. Also the gun must be allowed to cool after a certain number of rounds. Field guns by themselves are useless. One cannot pursue with "Heavies," nor can infantry get forward beyond the range of the guns. A slow advance gives time to bring up reserves to meet it.

A strong attack by the Allies in the west might push back the German line and gain a decision. It would require about 22,000 guns on the British front. It is impossible to maneuver in the west, as the flanks of the armies rest on unassailable obstacles.

If the Allies gain the Bosphorus and Dardanelles, their siege of the Central Powers will be complete except for the neutrals of Scandinavia, Denmark, and Holland. Therefore Germany must detach to the protection of Turkey even tho straining her resources, under the penalty of seeing Turkey, if strongly attacked, coming over to the Allies. The decisive point is the enemies' armies in the field. These armies must be maneuvered into positions where they can be broken without unnecessary loss to the opposing side.

[In the Spring of 1917. By H. Bidou. *Land and Water*, Apr 12, '17. 2000 words.]

There are only two means by which the Central Powers can emerge victoriously from the war. The first is by dissolving by political measures the coalition formed against them; the second is by defeating their enemies separately, one after the other in successive theaters of the war. The latter has been the great means adopted by Germany, but it has failed in each instance. There seems to be no question now but that the Germans are preparing for a war of movement. They are training their troops for it in the rear in exercises where trench work plays quite a subsidiary part. They have also developed their medium artillery, which is at once powerful and mobile, at the expense of their artillery of position. It is also possible that force of circumstances is reviving the war of movement. The solidarity of even the best prepared positions is now doubtful in the face of artillery fire of such magnitude as obtained on the Somme. There is the possibility of a German offensive with the masses of maneuver which the creation of the divisions of series 230 has enabled them to accumulate, and which will be attended by an extremely powerful artillery. Since this artillery will not reach its perfection until June, when Germany will have ten times as many heavy batteries as she had at the beginning of the war, our enemy now has as much interest in postponing the battle as in 1916 she had to precipitate it.

[Wearing Down the Enemy. By Hilaire Belloc. *Land and Water*, May 3, '17. 4300 words. 2 sketches.]

The forces of Germany and her allies are composed of two equal halves. One-half is based on the recruitment of the German Empire; the other half on the remainder of the group.

The remainder of the group can lend no aid to the German Empire on its own front. All the resources of Austria-Hungary are pinned; all those of the Turkish Empire; all those of Bulgaria. So long as any effective Russian pressure is kept up, so long as Italian pressure is kept up, so long as the forces based on Salonika immobilize the main part of the Bulgarian army, and so long as the Russians in Armenia and the British in Palestine and Mesopotamia contain the Turkish divisions. These things being so, the German half of the combination, which is also the directing

half and has much the best material at its disposal, must fight its own battle. It is the action against this German half which will be decisive.

The Somme offensive compelled the Germans to throw into the process of rapid wastage more than one hundred divisions and to suffer a total loss, first and last, of 700,000 men. They had to face the renewal of this process on a more dangerous scale in 1917. They created a considerable strategic reserve, (probably about 25 divisions of something over 15,000 men each, with drafts to fill the gaps in the ranks in the first few weeks of fighting) and prepared a plan which, so far as can be judged, was intended to help them use this strategic reserve on their own initiative.

The plan was, first, to gain time by an unexpected retirement coupled with an unexampled devastation of the ground over which the pursuit must pass; secondly, to use the time so gained for obtaining a great and increasing advantage over the Allies thru the progress of the submarine campaign; thirdly, while the submarine campaign was gradually paralyzing the power of munitionment and supply enjoyed by the Allies, to keep the war going without a decision against Germany either (a) by creating a sudden new offensive in an unexpected field with the aid of the strategic reserve in hand; (b) reverting to open warfare as much as possible in the west and using the strategic reserve there for checking the Allies in such warfare; or (c) a combination of the two.

What happened was something different from what the enemy had planned. In some points his plan matured successfully. In others it failed.

The submarine campaign was, in the main, successful. The plan by land has certainly failed. The whole great drama therefore, now turns upon the answer to a question which the future hides from us: whether the enemy's disappointment in the second, or land, part of his plan and his failure in it will proceed at such a rate as to neutralize his comparative success in the first part of his plan, the submarine campaign. This study deals only with the land side of the problem and here we have three forms of superiority that the enemy cannot take from us: great superiority in artillery, superiority in the air, and superiority in morale.

[The Political Factor. By Hilaire Belloc. *Land and Water*, May 17, '17. 6300 words. 1 sketch.]

It is plain to every observer that a critical moment of *political* character has come upon the war. It was inevitable that such a crisis should come coincidently or very nearly so with the military crisis that is rapidly approaching.

This, the greatest of all wars, has now clearly reached a stage in which the original political circumstances must be revised if we are to estimate the actual military situation. Two political events of capital importance have just happened almost at the same moment. Each of them suddenly creates a great military factor which was absent a short time ago. Each creates a new set of political conditions. The first of these events is the Russian Revolution; the second is the determination of the American government and people to join the Allies.

The Russian Revolution is still passing thru rapidly changing phases of development. Those who know the country best cannot pretend to judge what the next phase will be. There has been considerable disorganization in the Russian armies, and unity of direction is for the moment jeopardized.

All this reacts upon the whole field of war. To take two opposite poles of its effect, it weakens in Sweden a deeply rooted historic mistrust of Russia; and it changes to some extent the nature of any negotiations which might be undertaken with the Turkish government.

The entry of the American Republic eliminates from the list of neutrals the chief one. The effect of this is already felt not only upon the policy of blockade, but also upon the whole of Allied finance. Later it will be felt in the department of man-power as well. Further it is felt in all the present discussions upon the chances of the enemy's submarine program.

These two prime changes are not the only matters which have produced the critical political character of the present moment. We have added to them the fact that the next few months are the height of the season in which military action can be developed with the greatest intensity, in the west at least—better visibility, longer daylight, drier ground, less sickness.

These same months are also those in which the strain for food will be especially severe in all belligerent countries. As a last isolated point of great importance should be added that this is the moment from which onwards the original, fully conscript belligerent powers, and in particular the Central Empire, necessarily decline in numerical strength, leaving the powers which came later into the struggle or developed their military resources later, to throw in their decisive weight.

All these considerations being reviewed, and each given its due weight, there has arisen—on account of their number and complexity—a division of general opinion.

There is one group of opinion which looks to a deliberate prolongation of the war—what is called "marking time"; and there is another group of opinion—happily that of all those responsible for our public action—which has decided that *the present season determines the result of the war.*

The enemy is now out-classed in finance, munitionment and recruitment. The great offensive of 1917, now but little more than a month in progress, has already clearly and definitely given the Allies the initiative.

It is the strain which 1917 *shall impose upon the enemy, the result and success of that strain, which will decide whose object may be attained: Our enemies' or our own.*

[War Notes. By Captain H. M. Johnstone, R. E. (retired). *United Service Magazine*, June, '17. 4000 words.]

It is the widening of the front of strenuous attack

EUROPEAN WAR—Continued

on which the Germans are being assailed in France that is calculated to try the enemy beyond his power of endurance. The great essential at the present stage of the war is not so much to strike with special fury in one sector as to strike everywhere with fury. Nothing decisive can be gained until the English and the French together are operating in active attack over a front of at least 50 miles. German fronts are coming to depend on the action of the enemy—a condition abhorrent to all good soldiers. The French and English, in the great majority of their soldiers, have men who individually are keen to conquer, and individually are fit to act in that direction with all their wits about them. It usually takes a whole platoon or company of Germans to show either initiative or courage such as the Allied troops would show on all occasions. The German operations in the vicinity of Arras have been of such a kind as to indicate the presence of plenty of troops in that sector. The extreme tenacity which the enemy is showing east of Arras may have some connection with the preservation of the huge magazines he would collect for his proposed strategic stroke from north or south. The Allies' progress has been slow in this region, but progress in disposing of the Germans has been most satisfactory. There must be a special reason for the extreme obstinacy with which the Germans have been defending their lines from Lens to the Bapaume-Cambrai road. They are probably finding the people at home and the Army at other parts of the front becoming so skeptical of the value of retreating strategy that it is unsafe to feed them any more of that class of argument. The English venture into Fresnoy proved too bold. Nevertheless the enemy had to make a very special effort for recapture, and to use for the operation some of the very best of his troops. In the first few days after the Russian revolution, some of the German papers suggested that "the Russian soldiers who still remained at the front" were only staying there under a formal promise from their government that they would not be called upon to do any more attacking and that peace would be signed in two months. Some of the papers of Austria and Hungary, however, have given frank opinions that no good can come to the Central Powers from the Russian revolution. The first idea was that anarchy would reign in Russia, but it was not long before it was seen that the Army was pulling itself together and that a substantial majority would vote for continuing the war to the stage of victory.

[Chronicle of the War. *Memorial de Caballería,* June, '17. 6800 words. 2 maps.]

Résumé of the situation to June 1. The Central Powers continue to maintain the defensive, estimating that they have already obtained all the fruits of war that are reasonable and possible. The submarine warfare appears to cause more suffering to the Allies than the military operations. The Allies have not abandoned their aggressive purposes, but their energy seems to be failing rapidly. The English in particular have not obtained the results that the strength and equipment of their army led them to expect.

Russia accentuates her pacific attitude. The aid of Japan and the United States has amounted to but little more than the sending of light fleets to European waters.

In these conditions it may be expected that if the Entente should fail in a new general offensive, and peace be not established immediately, the Central Powers in turn will take the offensive on a large scale before autumn.

[The Contrast. By Hilaire Belloc. *Land and Water,* June 21, '17. 3200 words.]

Perhaps the best exercise for those who are now affected by the strain of the war, its prolongation and severity, is to set down on paper what must be expected on the one hand from a negotiated peace, and upon the other from a true victory.

The war became in the west, after the victory of the Marne, a siege war, and for the character of a siege war the popular mind was ill prepared.

The character of a siege in all times has been a wearing down. In every siege which the historian can mention, victory has been granted to the greater tenacity, the greater vision, the greater length of both will and of view.

Up to the last moment, in every siege, the men in the outer lines have said "this will never end." But a siege, like any other operation of war, involves victory or defeat. If the besieged compel their opponents to negotiate, if they maintain their position, and having maintained it secure the core of what they suffered for, then they have gained a victory as truly as any victory is gained by rapid movement in the field.

A siege warfare conducted to its conclusion, the imposition of the will of the victor upon the vanquished, is the most conclusive of all.

If the enemy shall succeed in wearying the tenacity of his opponents, and in establishing the conditions of a truce and later of a settlement, coming generations would be under the spiritual domination of Prussia.

Men would say that the power which had defended itself so successfully was in the order of things. They would imitate it, even where they did not revere it.

In general, the Europe of the future would suffer from the modern German attitude towards the world.

The war has produced a number of new acts in war which may or may not become precedents.

The enemy has made use of weapons which had been thought ruled out of our civilization. He has used treachery. He has torn up treaties. He has used poison. He has tortured prisoners. He has enslaved. He has murdered non-combatants. He has sunk innumerable non-combatant ships without warning, neutral as well as Allied. He has terrorized civilians by the bombardment of open towns. If those things remain without punishment, they have come to stay. But if those who have done such things are heavily punished for them—and only military success can secure that effect—it is not likely that they will re-arise in Europe.

But if there is no punishment then war has changed

into a thing that will be wholly destructive to our civilization. If Prussia comes out of this war unconquered, slavery will re-arise in Europe.

[German Blunders. *Independent,* Aug 4, '17. 1200 words.]

We hear much of British blunders. The Gallipoli and Mesopotamia reports are enough to discourage any people except the British and to alienate any allies except ourselves. Because there is no such sharp criticism and frank exposure in Germany, we are apt to assume too great a degree of efficiency and thus overrate the enemy.

But Germany has made blunders. The first was that of precipitating the war, which no one questions Germany could have prevented or postponed. The Germans miscalculated in various ways. They ran short of shells in the first few weeks, and lost time in Belgium for which the defense of Liége does not account. They burned Louvain and shot Edith Cavell.

The German armies took the wrong road at the start. The 42 cm. howitzers might have succeeded against Verdun as they did against Liége, thus opening the way into France without involving Great Britain. The delay of the Crown Prince in getting to his appointed place in the march on Paris has not yet been explained. Of the commanders of the eight German armies that invaded France, none remain except the Crown Princes who are irremovable, no matter what mistakes they make. Von Hindenburg is about the only one left of the 1914 leaders. We know why Sir John French and Gen. Nivelle were removed, but not why Moltke or Falkenhayn is no longer Chief of the German General Staff.

In the early days the Germans might easily have reached the English Channel, something their later endeavors have failed to achieve after heavy sacrifices. The Belgian and British forces were allowed to escape from Antwerp. The persistence in the attack on Verdun was a frightfully expensive mistake. The faith in the Zeppelin was unwarranted. The elaborate food distribution system went wrong, and Batocki, the food dictator, vanished from sight. Last year a quarter of the potato crop rotted in the ground.

These are a few conspicuous instances of mismanagement, and the list could be extended. In the main, they show disconcerting efficiency, but they are mere human beings after all. The Germans do not tell all they know respecting themselves. Would they, in the midst of war, publish confessions of faults like the Gallipoli and Mesopotamian reports?

[The Line of Pskov. By Hilaire Belloc. *Land and Water,* Sept 13, '17. 3300 words. 1 sketch.]

Notwithstanding the present eclipse of Russian military power the war is as much as ever a siege. It is a siege upon one sector of which the besiegers have suffered a disintegration of their forces

Were the siege one in which the besieged could hope for external succour, or were they still in full force this failure would be disastrous to the whole Allied cause. As things are, however, the political collapse upon the Eastern front cannot have catastrophic consequences for the reasons that, first, there is no relieving force to appear upon that sector and secondly, the forces of the besieged are insufficient to take full advantage of their belated political success upon this side.

In general terms the most significant effect of the Russian breakdown is the diminution of this wastage which it affords the enemy.

The Allies have by now actually killed, counting those who died from diseases, four million of their opponents—and half of these are Germans. But the rate of loss in both the Austrian and in the German armies, in spite of the regularly increasing severity of the Italian, French and British artillery fire, has steadily decreased since Russia first began to give way eight or nine months ago. The reason the enemy cannot now develop a sufficient power to obtain a decision on the East and therefore to concentrate next wholly against the West is that the task set him upon the West is out of all comparison with what is going on in the marshes of Russia. The German Empire has *more than two-thirds* of its whole active force drawn into the defense of the line in France and Belgium; and even so it suffers repeatedly and continuously upon that line from the superiority of its opponents. A general summary of the situation is that tho the Central Powers have proved their superiority upon the East, they have at the same time proved their inferiority against the older and better civilization of the West and South of Europe, from which they themselves drew their culture.

—Mines

See

MINES—USE OF, IN EUROPEAN WAR

—Motor Transport

See

MOTOR TRANSPORT—USE OF IN EUROPEAN WAR
MOTOR TRANSPORT—USE OF AFTER EUROPEAN WAR

—Munitions and Munition Materials

See also

EUROPEAN WAR—AMMUNITION
RUBBER

[The War on Land. *Army & Navy Gazette,* Dec 30, '16. 1800 words.]

The necessity for an unlimited supply of ammunition was realized, probably first by the Germans, and then by the Allies when the expenditure rate became such that a 200-yard section of the French front in Artois received 4000 shells, mostly of large caliber, in three or four hours; and when the Germans abandoned a trench in Champagne only when it had received in two hours eighteen shells to the meter. The Germans with their better organization quickly put to work to the limit of their capacity all munition plants, and by the end of 1915 had obtained a big lead over the Allies. This lead has been gradually cut down by the slower moving allied governments, until now the Germans have been overtaken and passed.

The British have been confident of victory since the battles of Ypres, when they held the Germans

EUROPEAN WAR—Continued

who had a superiority of five to one in shells and three to one in men. The battles of Neuve Chapell", Loos, and Champagne were experiments. The Somme battle beginning July 1, was another experiment which showed that the British have improved upon Loos. It also showed that the Germans could prevent a breakage on a twenty-mile width of attack. So perhaps the British and French intend in the near future an attack on every yard of a fifty-mile front.

[Test of Democracy in War. *Army & Navy Jour.*, Mar 10, '17. 900 words.]

The popular demand in France is for younger men and for a more dashing offensive that will promptly recover her invaded territories. Offensive is recognized by unanimous consent to be less a question of men that of material. The Germans are going further and further in the art of replacing men by armament. They entrust the defense of trenches of the first line to few men and many machine guns with a view to mimimizing casualties, their plea being that ten machine guns are better than 250 infantry rifles to repel an attack. Since the battles of Verdun and on the Somme, when both sides learned the necessity of unlimited supply of materials, the race has started between the Allied and Germanic arsenals, between the superior organization and methods of the Germans and the superior resources of the Allies.

Paris military opinion seems to have come to the conclusion that the war can never be won by local attacks, even if partly successful. A decision, it is realized, can only come from a simultaneous attack along the entire front. Hence the importance of improving the means of transportation in the rear of every sector so as to permit a quick concentration of guns and troops, which is being recognized by both French and British.

[Scrap Metal from Europe's Battlefields. *Scientific American*, Aug 4, '17. 400 words.]

Observers recently returned from the front state that a salvage corps goes over the ground near the battle front daily to gather up the debris. Scrap metals are collected and taken to the rear to be worked over.

Great Britain

[Shortage of Gasoline in England. *Scientific American*, Nov 11, '16. 200 words.]

The gasoline famine is due to the fact that the Navy Department has requisitioned many tank steamers for its use and neutral countries do not care to risk their vessels. There is a dearth of cans because the cans are very useful in the trenches for various purposes, and so never come back. It is hinted that many cans are hidden, in contravention of recent laws limiting the use of motor fuel.

—Munitions and Munition Materials—Orders for in Canada

[Orders for Canada. *Independent*, Jan 15, '17. 200 words.]

In Canada there are many new munition works. The orders placed there since the beginning of the war amount to $1,000,000,000. In some cases much of the work has been turned over to manufacturers in the United States. The largest of the recent orders, which amounts to $150,000,000, is held by the Montreal branch of the American Locomotive Company.

—Naval Lessons of the

See also

EUROPEAN WAR—MILITARY LESSONS OF THE
SUBMARINES—USE OF IN EUROPEAN WAR

—Naval Operations

See also

SUBMARINES—DEFENSE AGAINST—NETS

[The Blockade of New York. By Arthur Pollen. *Land and Water*, Oct 12, '16. 2700 words.]

The Germans have met the popular demand for a more ruthless use of their "most powerful war weapon" by a blockade of New York harbor. Three nations have till recently competed for the privilege of being most hated by the Germans, England, Russia and the United States. Hindenburg, the popular idol, has decided that England must be most hated and Russia the most feared. The competition then is now limited to the two great English-speaking peoples. The blockade of New York, being a blow at each of them, surpasses Mackensen's decisive victory in the Dobrudja, Falkenhayn's triumphant advances in Transylvania, and the successful issue of the latest war loan, as a tonic to Germany's weakening spirit. The blow to British shipping so far is not a serious one, but it has been inflicted in circumstances of sensational publicity which gives it great value in raising German morale. The real greatness of the thing lies in combining with the blow an affront to the Americans. Unquestionably a situation of unusual delicacy has been created.

[Trafalgar Day. By Arthur Pollen. *Land and Water*, Oct 19, '16. 3000 words.]

Trafalgar Day is celebrated this week for the third time during the war. The position on Trafalgar Day, 1914, was most discouraging and depressing. The *Emden* and *Karlsruhe* were both in mid-career. Two only of the German commerce-raiders had been sunk; *Kaiser Wilhelm der Grosse* by *Highflyer* and *Cap Trafalgar* by *Carmania*. The balance of naval loss was heavily in favor of the Germans and the failure of the naval brigade at Antwerp had become public property. Still more discouraging was the failure of the French and British naval forces in the Mediterranean to prevent the sending of the *Goeben* and *Breslau* to the Turks.

By Trafalgar Day, 1915, misuse of sea forces had once more brought British naval reputation down. After the battle of the Falkland Islands the First Lord of the Admiralty became obsessed with the idea that the guns of the British pre-dreadnought fleet could batter down the Turkish defenses of the Dardanelles, force a way into the Sea of Marmora and compel the capitulation of Constantinople. Napoleon's idea that India could be conquered without the use of sea power

was not intrinsically so bad as that Constantinople could be conquered without the use of an army. The forcing of the Dardanelles by ships alone was from the first obviously impossible, and as a purely naval effort doomed to failure.

How do things stand to-day? British strategy in the North Sea has thruout been defensive. It was left to the Germans to make advances to a battle. Both fleets were entrenched. Both could, and did, make sorties. But the North Sea was held by neither. It was a No Man's Land that either might enter—to the peril of the weaker if their sorties were to co-incide. There was and is, no military blockade of the German ports: no effort to stop their small and under-water vessels from getting to sea at all. German success against British, Allied and neutral merchant vessels has been great. Over 3,000,000 gross tonnage of British shipping was gone before the third anniversary of Trafalgar Day came round. Allies and neutrals have lost at least half as much again.

The general naval position has not changed except for the battle of Jutland. That battle was decisive in that it proved that the German fleet does not aim at commanding the sea by defeating and destroying the British fleet. The German fleet came out 200 miles from its own harbors; if the event showed that Scheer and von Hipper were not prepared to fight to a finish, it also showed an absolute faith in German capacity to prevent the British fleet pushing an engagement to a final issue. As it happened, it was an accident of the weather that enabled the German admiral to realize his plan. Viewed simply as a naval operation, he is entitled to the credit of a tactical success in that he evaded the loss of his fleet. That evasion was achieved at a cost that left the relative naval inferiority of Germany greater than ever. From every point of view then, the battle of Jutland, however creditable to German leading, German technique, and German seamanship, remains without question a grave German defeat.

—Naval Power in

See also

Great Britain—Navy

[Sea Fog. By Arthur Pollen. *Land and Water,* Oct 26, '16. 2000 words.]

One of the advantages of Zeppelin scouting is that in clear weather the enemy is enabled to get information as to the disposition of the British fleet. The exigencies of naval war are such that the public, whose interest in the fleet is surely not less, cannot be allowed to share the information. It is therefore impossible to present any clear picture of the strategic position in the North Sea, or to indicate how, if at all, the battle of Jutland has affected it.

The other field of naval war, namely, the submarine campaign against trading ships, has been veiled in almost as great a mystery as conceals the movements and dispositions of the opposing fleets. Some information is published about the losses of ships as they occur, but reports are not complete. Without complete reports it is impossible to elucidate the main characteristics of the campaign, to indicate how far the Germans are complying with the definite undertaking that they gave to the United States of America, or to forecast the future. Could not some way be found by which the public could be given the truth in a matter of such tremendous importance as this without any details being given away that would be of value to the enemy? At present it looks as if the public were being invited to form views as to the danger from submarines that are alternately optimistic and unnecessarily alarming, and as to the danger of invasion that are altogether baseless.

[The Channel Raid. By Arthur Pollen. *Land and Water,* Nov 2, 1916. 3300 words.]

The submarine—and ingenuity—have enabled the Teutons to carry the art of evasion in naval war to a point hitherto undreamed of. It follows that the chances of the superior force gaining popular, or picturesque successes, must be singularly few. Thus is thrown upon the British navy a task that has never in any war been perfectly performed, and in modern war never can be.

The trade to be protected is that of the whole world. Under-water attack, whether active from the submarine, or passive from the mine, is absolutely sure of taking a certain toll from it. Any toll will be looked upon as proving the failure of the admiralty's defense.

The modern inventions of scouting aircraft and slinking under-sea craft, have added greatly to the possibilities of naval sorties.

A naval war in which one side is so predominant that the other avoids action, may resolve itself, in the absence of a decisive battle, into a series of minor successes by the weaker power. The stronger power, however strong it may be, cannot be equally strong at every point that is open to attack.

When the forces of the weaker side have been concentrated behind a comparatively narrow front made not only impenetrable, but almost unapproachable by mines, there exists apparently no means either of hunting them down in their lairs, or of blockading them there. As a consequence there is the curious phenomenon that the initiative is with the weaker and fugitive force.

The raid on the Channel transport route on Oct 27th is remarkable only in that it is the first of its kind. The explanation is that the general military position of the enemy is such that risks now have to be taken at sea that seemed prohibitive twelve and twenty-four months ago.

Naval sorties and raids combined with the new vigor of the submarine campaign are to be expected. The promise to Washington of May 4th, has already been and will henceforward be ignored when inconvenient. The German government seems convinced either that in no circumstances will America fight, or that in any circumstances her doing so will make no difference. The people at least are persuaded that it is American munitions that are turning the scale on the French front, so that American neutrality already seems to them a name only.

The German naval policy is now one of desperation.

EUROPEAN WAR—Continued

[The Sea War in 1916. By Arthur Pollen. *Land and Water*, 4 Jan, '17. 3700 words.]

The war has reached its culminating point without a single decisive engagement at sea. After two years of almost absolute command of sea communications, we have, during the last five months, seen these communications attacked with disquieting success.

The submarine attack upon sea-supplies, as recently developed, has qualified British sea command to a very unexpected extent. It is agreed that if the German fleet were destroyed the problems involved in the use of mines, blockade of the submarine exits, etc., would be radically changed in favor of the British. It is essential then to ask: Is the continuance of the present position due to the strategy which the British have pursued, or does it arise simply from the determination of the enemy to avoid a decisive issue? The battle of Jutland does not afford complete data for answering these questions, because of the change in the weather conditions that took place.

The three chief actions of the war, namely, the Falkland Islands, the Dogger Bank and the Jutland battle present an astonishing revelation of the inefficiency of modern long range gunnery. At the Falkland Islands it took sixteen 12-inch guns five hours to sink two armored cruisers. At the affair of the Dogger Bank, *Lion, Tiger, Princess Royal, New Zealand* and *Indomitable* were in action for many hours against three battle cruisers and an armored cruiser and for perhaps half the time at ranges at which good hitting is made in battle practice. Only the armored cruiser, whose resisting power to 13.5 projectiles must have been very feeble, was sunk. At the Jutland battle had both sides been able to hit at the rate of one hit per hour per gun, the Germans, roughly speaking, should have sunk six British battle cruisers, and the four ships of the Fifth Battle Squadron nearly twice over. The Fifth Battle Squadron should have sunk four German battle ships, and the British battle cruisers seven German battle cruisers. It is safe to say that the Germans could not have made a quarter of this number of hits, nor the British more than a third. It would seem then that at the most the British made only one hit per gun per three hours and the Germans one hit per gun per four hours. At no time thruout such parts of the action as have been considered did the range exceed 14,000 yards. In some periods it was at 8000 yards. In practice firing in all fleets, hits at the rate of one hit per gun per four minutes at 14,000 yards have constantly been made. It seems elementary to say that a resolute effort should be made at once to find out if science is equal to the task of reducing battle conditions to battle-practice conditions. If only 25 per cent of the errors could be removed at the above figures, the rate of hitting in battle could be improved by over eleven hundred per cent.

[The Navy and the War. By "Admiral." *Journal of the Military Service Institution*, Jan-Feb, '17. 9000 words.]

(The sea pressure of the Allies is slowly and surely making itself felt. A comparison of the probable results of the blockade with those of the U-boat war is drawn to show that the former is the more effective and that the latter is a hopeless task. The effect of placing in command of the English fleet, a man of offensive tendencies, and a criticism of the naval caution shown in the first year of the war take up some part of this article, written to show that the Navy is performing its obligations in the great war.)

[The U. S. Navy in the War. By Arthur Pollen. *Land and Water*, June 7, '17. 2500 words.]

For many weeks German public speakers and writers have been almost entirely silent on the part America is to play in the war, with the single exception of Harden, who has been allowed to warn his countrymen that to underrate American power will be as foolish a blunder as was the original belittling of Great Britain.

This boycotting of the subject is significant. There is manifestly a strong political reason why the change created by American intervention should not be too early brought home to the people of Germany.

Not the least probable explanation is that the Central Powers are likely to make an early offer of peace, that they wish the President and Congress to be on their side when the offer is made, and so are wisely abstaining from discussions which might lead to provocative and insulting language, and so to a further exasperation of American sympathy. Probably for a similar reason no attack of any kind has yet been made upon any American seaboard town.

It is certainly significant that we have heard of so few American ships and so far no liner being sunk, or even attacked, by submarines.

It is possible that the Germans for the moment are doing all they can to prevent Americans from being spurred on to make greater efforts in the war.

The natural deduction is that they are none too pleased with the possibilities of the situation.

The Conscription Bill has passed both Houses, and the machinery for raising the first half million is being set up. Before the snow is off the ground next spring, the first American armies, of 100,000 men each, will be taking their place with their arms, equipment and reserves complete; and a second half million will be getting ready to support them before summer passes into autumn.

This is not a prospect that can be faced with equanimity—but it is only one of the possibilities of the situation.

The ultimate share of the American navy in the war may seem to be only less obviously decisive because we are accustomed to looking upon the preponderance of the British fleet in the North Sea as a thing so well established as to need no reinforcement. This general view of the question does not take account of changes in the political situation which are far from improbable.

Since the beginning of the war, Norway has lost over 500 ships, displacing approximately 750,000 tons. That country has been losing ships since the beginning

of the ruthless submarine campaign at a rate exceeding 50 per cent per annum of the peace time tonnage. There may be many reasons why Norway should keep out of the war. There is here manifestly one reason why she should come in. In Sweden, Norway, and Spain, the effect of the American example has been profound. In Norway and Sweden the effect of the Russian Revolution can hardly have been less. The traditional distrust of Russia, now that Finnish liberties have been restored, is gone forever. Sweden's loyalty to this tradition survived even the astounding series of insults to her sovereignty.

No doubt the patience of Norway, under the steady destruction of her marine, has been due first to a consciousness that Sweden was unlikely to co-operate, and secondly to a not unreasonable doubt that Great Britain's hands might in a naval sense be too full to afford the help that belligerency would make imperative. It is exactly at this point that American intervention changes the entire situation.

With eighteen battleships, whose aggregate gunpower is vastly superior to that of the whole German battle and battle-crusier fleet, the Americans are in a position, should Norway elect for belligerency, to establish a North Sea base directly threatening the Sound, Heligoland and the exists of the German fleet.

With Norwegian territorial waters no longer neutral and with the Sound no longer an open passage, the problem of the closer blockade is entirely revolutionized.

There is also the possibility of direct offensive operations against the German bases to be considered.

Should Spain also elect for belligerency, the possibilities for naval co-operation from a continuous string of bases from Kirkwall to Gibraltar open a new field for the sea arms of all the Allies.

The Americans have been extraordinarily prompt in offering what aid was available, and the efficiency of the craft already over here is hardly surpassed by the goodwill and energy of the officers that command them. The mere presence of so vigorous an ally has put fresh heart into the public.

[Naval Losses of the War. *Army & Navy Jour.* Aug 11, '17. 500 words.]

In three years of war to July 31, 1917, authentic and official records show a total loss of 525 warships of all classes, distributed as follows: Germany, 194; Great Britain, 151; France, 45; Turkey, 42; Austria, 31; Italy, 23; Russia, 23; and Japan, 10. The United States has lost one converted yacht and five light draft gunboats by internment. Thus the Allies have lost 258 warships against 267 for Germany and her allies.

Gunfire shows itself supreme, as 146 vessels have been thus destroyed, as against 138 by submarines and 66 by mines.

Tabulated losses are as follows:

Great Britain and her Allies: by gunfire, 40; by submarines, 90; by mines, 53; wrecked, 14; by internal explosions, 9; by airplanes, 1; rammed, 1; by collision, 14; blown up to avoid capture, 5; unknown causes, 20; torpedoed by warships other than submarines, 5; interned, 6; total, 258.

Germany and her allies: by gunfire, 106; by submarine, 49; by mines, 13; wrecked, 6; by internal explosion, 1; by airplane, 7; rammed, 7; by collision, 1; blown up to avoid capture, 12; interned, 18; captured, 22; unknown causes, 19; torpedoed by warships other than submarines, 4; sold, 2; total, 267.

—Neutrality Aspects of

See also

BELGIUM—PRESERVATION OF NEUTRALITY
GREECE—HISTORY

—Peace Negotiations

[Prolonging the War. London *Spectator,* Nov 4, '16. 2200 words.]

The time is rapidly approaching when the Allies should consider the question of the undue prolongation of the war. If we inquire at this moment who it is that is prolonging the war, the answer is unquestionably Germany. It is she who is going to be beaten, and it is her will alone that counts in maintaining the struggle. Germany knows, and the whole world knows, that for our enemies victory is impossible. It is true that Germany does not admit this openly, and it is also true that the Allies will probably lose more in wealth and in men before they finally defeat the Germans. But that victory will be ours is inevitable. Germany is fighting on only because she believes that she will thereby in the end get better terms.

Under these circumstances, the position which the Allies ought to take is clear. They should say to Germany, "We have won the war and you know it; you have the power of prolonging the struggle and of making us suffer in common with yourselves for another year, or it may be for another year and a half. If therefore you do not make peace before the beginning of 1917, we shall very greatly increase the arduous character of the terms to which you will have to submit. These terms will also be progressively hard on your allies, Austria, Turkey and Bulgaria, and on the king, tho not on the people, of Greece. Every three months added by you to the total duration of the war after the first of January, 1917, will mean an increase in indemnity, a diminution of territory and a harder punishment for the imperial family, for the sovereign princes of Germany, for the great commercial interests of Germany, and for the German, Austrian, Hungarian and Turkish peoples. These terms may be injurious to the material interests of the Allies truly considered, but they will not carry so great an injury as the prolongation of the war. The whole world shall know that to enter upon a war as wantonly and callously as Germany did in 1914, and to maintain it as she has maintained it, is very bad policy for the beaten power."

To carry out this plan, the Entente Powers must of course formulate, and formulate at once in general outline, the terms which they will grant to Germany if the Germans will ask for peace; or, put otherwise, if they will try to discover the conditions under which

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hostilities may permanently cease before January, 1917. The statement of these terms may seem difficult, but as a matter of fact it is a good deal easier than people imagine. It would have in itself a beneficial effect from the Allies' point of view. It could, for example, hardly help producing a disruptive effect upon the German Allies. It would be impossible even for the German police to prevent discussion of these terms, not only in the domains of the Kaiser, but thruout Austria and Hungary. The effect of this discussion would be to make each constituent part of the Central Alliance anxious to see whether it could secure in some way preferential treatment by being the first to back out. It is obvious that we can speak here only very generally as to the character of the terms in question. To begin with, the German Empire may be reminded of the fact that Bismarck, in 1871, refused to treat with Gambetta and the French Provisional Government, and insisted that a National Assembly should be called as a body which alone could endorse the terms which Germany was willing to grant to the conquered. Further, and this is important, the Allies should remind the German Empire that in 1815 the Allies placed Napoleon and his family under a ban and refused to negotiate with them. This was a point about which no debate was allowed. Next the German democracy should be made to understand that altho they are not responsible for the war, they will have to be held responsible for its prolongation if they delay taking control of the affairs of their country and continue to allow those who now wield the destinies of the empire to remain in power. Again, the sovereigns of the German States must be reminded of the fact which they seem to have forgotten of late, *i.e.*, that Germany is a confederation and not a homogeneous country. Whether the full consequences of the crimes of Prussia should fall upon the Kings of Bavaria, Saxony and Württemberg, and the Grand Dukes of Baden, Hesse and so on; or whether these constituent States of the Confederation should be saved from these consequences, is surely a matter of vital concern to them. The Allies should be equally sharp in respect of the Dual Monarchy. It should be pointed out that altho the Entente Powers would like to treat their people as victims of pressure rather than as full conspirators, such terms cannot be granted to them if the Magyars of Hungary on the one hand and the mountaineers of Tirol, the Vorarlberg and the Salzkammergut on the other, make no effort to prevent the prolongation of the war. In the case of Turkey, we must warn those who hitherto have taken pride in the feeling that, thru the claims of Caliphate, they led the Moslem world, how terribly the position of Ottoman Mohammedanism is being compromised by its craven dependence upon the German Empire. The Entente wishes no ill to the Moslem faith, but on the contrary is determined to place it in a position of real independence. At the same time punishment for the prolongation of the war must of necessity fall to a very great extent upon the Turkish Empire and upon those Mohammedans who were bribed to bow the knee to Germany by the plea that Turkey was to become once more the great center of Mohammedan power.

Finally, in regard to the terms of the pressure to be applied, it is necessary only to say that no trained diplomatist, no man who knows the conditions of Europe, will find it difficult to set them forth. The policy of putting pressure upon the German Democracy if they neglect the duty of saving themselves, will be particularly easy. Germany must be reminded that her submarine policy is going to deprive her, not of the money value merely, but of the actual physical possession of a mercantile marine. But the process is not going to stop here; if the German people prolong the war unduly, they may find a system analogous to that of ton per ton for every trading vessel sunk applied in ways which they do not suspect, but which may be equally painful and equally injurious.

[Peace, Politics and War. By Frank H. Simonds. *Review of Reviews*, Jan, '17. 12,000 words. Portraits, map.]

The events of the past few weeks have been of surpassing interest. Rumania has met with complete disaster, Bucharest has fallen. Lloyd George with a new ministry has replaced Asquith and the coalition ministry, which had existed since the beginning of the war. Joffre has been retired, and finally Germany proposes a conference to make peace. One thing is clear in this proposal: Germany suggested no terms of peace, and it is pertinent therefore to inquire into her motives. There is reason to believe that Germany's proposal was not made with the idea that Germany could dictate a victorious peace. It must be recognized that so far the war has been a draw in a sense that neither side has achieved a victory, and that consequently no one can dictate peace. It is true of course, that the great successes of the war, apart from the Marne and Verdun, have been won by the Germans, but these successes are not of the sort that permit the victor to dictate absolute terms. Was it the conviction that absolute defeat was impending that impelled the Germans? Opinions will vary as to this aspect of the case, but there is no reason to believe that an absolute victory is possible for the Allies any more than it has been possible for the Germans since the battle of the Marne. If the Germans are then to be compelled to accept terms imposed by the Allies, it will be in consequence of economic pressure and of the presence of actual starvation. But these are not so imminent as to compel the Germans to ask for peace, which would be a confession of defeat in its terms. It rather seems to be that the German proposal was the result of a shrewd utilization of the recent victory, coupled with the recognition that the greatest profit that the war might have had will not be realized; that reasonable profit is all that the Germans can hope for now, and that the German people's desire for peace must be faced. It is entirely possible that the German government is impressed by the growing demand for peace. The German people still believe that they are fighting because Germany was attacked, and that it is necessary to defend their integrity, but they do not

understand why a war of defense should continue when German armies are fighting along the Niemen the Danube, the Cerna and the Aisne, and the last great campaign has ended in one of the most complete successes of the war. That there is real privation in Germany there can be no doubt, nor is there any prospect of its relief. At the beginning of the war, official German statistics showed that Germany had about 4,000,000 trained soldiers. The latest casualty list brings the losses up to about 4,000,000, and these lists are notoriously incomplete. Further, at the beginning of the war, the total trained and untrained population, officially estimated as capable of bearing arms, was about 10,000,000. Thus two in every five, at the least, of the able-bodied men have been killed, wounded or captured. For such losses victory is no final counterbalance if the victory does not bring peace, and if the war that inflicts them is not a war in which the life of Germany is at stake. Hence it seems likely that the German government has offered peace primarily because of the German demand for peace, if peace be possible without risking what is necessary to German safety and independence. The rejection of the German offer will have as a result the rallying of the German people to the support of their government and to the support of the war. Apparently, however, peace is not possible before the campaign of next summer is fought out, because Germany is not yet ready to restore Belgium and Serbia, evacuate France, return Alsace-Lorraine to France, compel the surrender of Trieste and the Trentino to Italy and to recognize Russian domination at Constantinople, and on no other terms will the Allies now make peace. Germany might offer to evacuate Belgium, make some concessions to Italy and restore Rumania to independence, but it is extremely unlikely that she would offer to restore Metz and the French-speaking part of Lorraine to France in return for the French renunciation of their claims to the remainder of Alsace-Lorraine. She will not, save in direct extremity, agree to restore Lithuania and Poland to Russia, agree to the restoration of Serbia and permit Russian occupation of Constantinople. The German people will not give up Alsace-Lorraine save under the compulsion of starvation. France will not make peace until she regains her lost provinces. Italy will not make peace without Trieste and the Trentino, and her Allies must, and will, stand with her. Austria cannot give up Trieste without losing her one great sea-port. Russia has the pledge of her Allies to guarantee the possession of Constantinople and all the Allies have pledged their honor in the matter of Serbia as well as of Belgium. All this amounts to saying that Germany is now in a position to offer to make peace and return a portion of what she has acquired, but that her enemies do not believe that she can permanently hold what she has won, and are satisfied that if she could, she would not only have won the war, but become a permanent menace to their safety and thus a guarantee of more wars. The war is thus a long way from being fought out. The nations engaged in it are a long way from being ready to concede that they are beaten. The restoration of Belgium, France, Serbia and Russia would be a defeat for Germany and the Allies to-day are not merely united upon a program that calls for the restoration of the *status quo ante,* but they also ask Alsace-Lorraine, the Trentino, Trieste and Constantinople.

Nevertheless, something has been gained; the German offer, altho it fails to prevent another campaign and new struggles, is the first sound of the project of peace. We shall have peace talk, we may even have formal and informal negotiations, but the most terrible campaign of the war must be fought out next summer.

In regard to future military operations, it is a question whether the Germans will undertake to push further east towards Odessa and Kiev, or turn south against Salonika. Whatever they do, the Rumanian collapse seems to indicate that the chances of the Allies to win a decision in the near east have disappeared. Rumania's aid is no longer an element. The German chances to obtain a decision and win the war in their own way ended at the Marne. Their chance to get a separate peace from Russia ended a year ago; their final chance for a decision in the West crumbled at Verdun. But this does not mean that the Allies will go to Berlin or even to Vienna. Economic, rather than military, elements will settle the war, for apparently the military battle is tending toward a draw. The Allies probably will push the Germans back to the French frontier, but such a campaign will cause enormous losses, and holds out no bright prospects of actually piercing the German lines and a return to a war of movement and the chances of a great crushing German disaster.

[The author then goes on to describe the downfall of the Asquith ministry and the rise of Lloyd George to power, with a war council of five, consisting of George, Curzon, Milner, Bonar Law, a Tory leader, and Henderson, a representative of Labor.]

Lloyd George expresses in a concrete way, the British determination to win the war and win it at the cost of ultimate sacrifice and effort. England is not in a peace mood, and the German proposal for peace comes at the hour when the British have resolved to fight for a "knockout." The ministerial changes in England are paralleled by similar changes in France. Joffre has been displaced by Nivelle. Moltke lost the campaign in France. Falkenhayn lost Verdun. French lost everything that a general could lose, and the Grand Duke Nicholas departed after a long series of disasters. But Joffre goes after having won the great triumph of the war and maintained his victory. It appears that the strain of his long service had been too much for him. France seemed to need a new man and a younger man. The selection of Lyautey to succeed Roques as minister of war is apparently more significant than the selection of Nivelle. He is a strong man, the sort of leader in critical times. In Morocco he has performed miracles.

To sum up, the crises that have taken place in Britain, France and Russia are the strongest reasons why the German proposal will fail to end the war. Instead, they will probably accelerate the pace of

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fighting when spring comes, and it is again possible to move in France and Belgium. Henceforth the part that Britain will play in the coalition against Germany will increase steadily and may even become commanding, if, as many Englishmen believe, Great Britain has found in Lloyd George another Pitt.

[The Conditions of Victory. By Hilaire Belloc. *Land and Water*, Oct 11, '17. 3200 words.]

The purpose of this article is to discuss the policy which consists in presenting hypothetical terms of peace, to show that this policy is necessarily favorable to the enemy and may be disastrous to the Allies. It is further proposed to show how it should be replaced rather by an analysis of the conditions, not of peace but of victory.

The German and Austrian Governments and those who sympathize with them began, after the loss of their defensive power following the defeats of Verdun and the Trentino, to start a discussion upon the terms of peace. The agents of the Central Powers and their dupes in every belligerent capital planted this discussion as a newspaper topic, and fostered its growth.

This apparently sincere and reasonable discussion of "terms of peace" is one of the few clever things which the agents of Berlin have done since the Marne. The policy is an able one and if care is not taken against it, it will succeed in defeating the Allies. It appeals in the most winning manner at the same time to fools and knaves.

The financiers who have no national interests and who naturally want an inconclusive peace (if only from the fact that their fortunes cover both sides and that a decisive victory would ruin one of those sides) are strong supporters of this policy, and the great mass of unthinking men are also attracted to it. The briefest examination, not only of the dates which mark this new policy but of its character, will convince one that the true motive of those who argue in its favor is to save the Central Powers, and in particular the German Empire, from the punishment due to the crimes of this war, and to leave their strength intact for the future. In a word the object of the whole affair is to save Prussia.

The plain truth in the matter is this. There is a State in Europe, the citizens of which have for long manifested a will which in its effect is extremely evil. Unfortunately it has been so tolerated as to become very strong, and to command a great body of allies. It has challenged the civilization of Europe feeling certain of victory. It has failed to achieve that victory. It has added one atrocity to another as the war continued. The peril of such an evil will must be exorcised if we are to live, and the only conceivable way of exorcising it is to break that will by defeating the armed force which is its only weapon. If this evil will be not broken, the future will be all war, domestic and foreign—a war without conventions, without restraint, degenerated into a doctrine of indiscriminate murder.

[The Crisis. By Hilaire Belloc. *Land and Water*, Aug 16, '17. 4000 words.]

England is for the first time after three years of effort in grave peril of defeat. And that peril is wholly political. Now that the military situation is secure and that the peril is purely political the more outspoken criticism is, the better; for an evil of this sort can only be met by open dealing.

The ground upon which the political forces work in favor of defeat is ground prepared by fatigue.

Prolonged strain produces "war-weariness." It has usually been the determining factor in the principal struggles of human history. The elements now working for a disastrous peace may be categorized as follows: (a) Men of pacifist sentiment—these groups are the most obvious but the least serious; (b) the so-called "labor leaders" who have recently been holding political caucuses in the various belligerent countries—the action of these is the most directly dangerous, and (c) certain groups of international financiers—this element is the most powerful and the most to be dreaded. It is a fact that this powerful cosmopolitan element whose interests belong to no one nation, nor even to Europe as a whole, believe the moment opportune to make peace by negotiation.

A negotiated peace at the present moment means this: That an armed power in Europe, its armament supported enthusiastically by all its nationals, could violate treaties, could introduce into war horrors hitherto unknown, could enslave Europeans, could massacre and could yet remain strong and unpunished. It would mean that England, having drawn the sword, not only with a fighting object, but after public reiteration of that object, sheathed it again with an apology and a confession that it had not the strength to attain the goal for which it had set out. It would mean that the various Allies would enter a future in which each was conscious of defeat and each at heart would be blaming the others. It would mean that the greater part of European civilization would regard the German defense and its success as the capital military event of the modern world and would see in the armed power of Central Europe the one foundation upon which it could repose.

It would mean the control of the Near East; of the Polish people, of the Baltic and the Black Sea and their twin straits by those who are now our enemies. It would therefore mean the permanent and perhaps rapid decline of western civilization.

It might mean, if the West remain sufficiently strong, a cycle of wars. It might, and more probably would, mean, a peace of deeper and deeper humiliation.

The only alternative is victory.

[The Conditions of Victory. By Hilaire Belloc. *Land and Water*, Oct 18, '17. 3000 words.]

(Continuation)

The writer began this series of articles by the statement that the enemy could not escape ultimate defeat—in spite of the Russian collapse—save thru some political maneuver.

This maneuver was the propagation first by his

agents, next by his friends and afterwards by their dupes of three consecutive propositions.

These propositions were that the German people at large were not responsible for the war, and its hitherto unknown atrocities; that the defeat of the Central Powers in the field was impossible, and that therefore it was necessary to negotiate; and that as it would be necessary to negotiate, it would be well to state at once in detail the terms of a peace which the Allies could accept.

The first proposition was dealt with in a preceding article. This article deals with the second proposition concerning negotiation.

The main fact about this proposition is that it originated with the enemy, and is now advanced by him.

The original motive and action of the enemy stands historically unassailable. The enemy proposed to master Europe, and was certain of his power to do so.

So long as he had the slightest chance of victory, he conceded nothing, but talked openly of indemnities; of the probable annexation of French territory; of the certain annexation of Belgium; of the punishment of Italy, etc., etc.

He now puts the matter as follows: "A decision in the field is impossible short of mutual ruin, therefore, let us negotiate."

The reason for this marked change of attitude is that the enemy, formerly certain of victory on a purely military calculation, is now on the same calculation equally certain of defeat. He has only the political avenue of escape left him, and therefore he has turned to that.

The doctrine that a decision is impossible is nonsense.

Both parties suffer increasingly, but the party which is now in the process of undergoing progressive defeat, suffers more and more, and the victors, less and less.

It would be madness now to check the progress of the enemy's defeat by accepting his demand for a parley and a truce. (Continued.)

—Operations, Elsewhere

See
"Emden," Operation of the

—Prisoners

[European War. Humanitarian Labors of the King of Spain. By Adolfo Posada. *La Lectura* (Madrid), Jan, '17. 1500 words.]

The bureau established by the King of Spain in his palace at Madrid, principally for the relief of prisoners of war, has extended its field until now it has the following departments:

1° Reports and news of wounded and of prisoners, to be communicated to their families; efforts are made to find the missing, or those reported as having disappeared, and to improve the condition of the wounded.

2° Reports and news relating to civilians, either those interned in Germany, or the inhabitants of the zones of invasion.

3° Dispatch of communications between families or persons unable to communicate directly.

4° Dispatch of funds to prisoners and civilians.

5° Exchange of prisoners, and of the desperately wounded.

6° Betterment of the condition of persons, prisoners and others kept in camps of concentration.

7° Efforts to save the lives of those condemned to death, and to better the condition of those undergoing cruel sentences.

8° Miscellaneous, but with special reference to *humanizing* the war as far as possible, e.g., the efforts made by the King to induce combatants to allow the Red Cross and the military ambulances to pick up the wounded lying between the lines of fire.

As may be imagined, the work of this bureau has greatly increased and could not be carried on, had it not been completely systematized. Appeals are classified as soon as received, and each receives an immediate preliminary answer. The diplomatic representatives of the King in the countries concerned are then charged with the duty of obtaining the information, transmitting the funds, etc.

[British Prisoners Abroad. *Army & Navy Gazette,* Mar 3, '17. 125 words.]

Lord Newton's statement as to British prisoners held by England's enemies follows:

	Civilian.	Military.
Germany	4,500	35,000
Austria	200	2 or 3
Bulgaria	None	600
Turkey	700	*10,800

*Including 8800 Indian.

Lord Newton said that British subjects had been treated with great consideration in Austria and Hungary, in complete contrast to the treatment accorded them by the Germans.

[British and Enemy Prisoners. *Army & Navy Gazette,* Mar 31, '17. 150 words.]

There are thruout the British Empire 55,397 German, 16 Austrian, 763 Bulgarian and 15,512 Turkish combatant prisoners of war. The total number of British combatant prisoners in German hands is about 32,500.

[Prisoners in Germany. *Army & Navy Gazette and Broad Arrow,* May 19, '17. 135 words.]

At the end of last week the German Press was furnished with an official statement of the prisoners of war in the hands of Germany and her allies up to Feb 1. They are said to number 2,874,271. The vast bulk are Russians. British prisoners are given as 45,241, including 1706 officers and 43,535 men, distributed as follows:

	Germany.	Austria.	Bulgaria.	Turkey.
Officers	1,104	18	24	560
Men	32,025	13	604	10,893
Total	33,129	31	628	11,453

Of prisoners of war other than British the Germanic allies claim to hold the following:

EUROPEAN WAR—Continued

	Officers.	Men.	Total.
Russian	14,230	2,066,469	2,080,699
French	6,329	362,278	368,607
Italian	2,234	95,783	98,017
Belgian	658	41,779	42,437
Rumanian	1,536	77,497	79,033
Serbian	896	153,734	154,630
Montenegrin	31	5,576	5,607

Germany holds altogether 1,690,731 prisoners; Austria-Hungary, 1,092,055; Bulgaria, 67,582; and Turkey, 23,903.

Germany

[Economic Conditions in Germany. *Scientific American*, Jan 20, '17. 2400 words. Illustrated.]

Prisoners of war in Germany are much better off than they would be if with their armies undergoing the usual campaign hardships. The camps are located in healthful surroundings and are kept in good sanitary condition. The food is of such quantity and variety as to maintain health and strength. The mail service is excellent. Prisoners receive money, food, clothing, books and other articles sent from home. Athletic games, amateur theatricals, and art works of various kinds are encouraged by the Germans.

Of the three million prisoners in Germany, a million and a half are Russians. They are tractable and obedient, and have in great numbers consented to work. Without them Germany could not have harvested her crops in 1916. Next in number come the Frenchmen, among whom are found skilled laborers, mechanics, and professional men. Many of these work upon products which cannot be used as material of war.

—Railroads in

[The Services of the French Railroads in the Present War. By Col. Francisco Echagüe and Lt.-Col. Juan García Benítez. *La Guerra y Su Preparación*, Jan, '17. 4500 words.]

One of the conditions under which the French railways operate is that they place all of their resources at the disposal of the government when it becomes necessary to transport men or supplies for the army and navy. Hence in order that they might perform these duties efficiently in time of war, it was found necessary to create a military organization to assist in directing them. During peace the military service of the railways is directed by the Chief of Staff of the army under the authority of the Minister of War, the General Staff having a bureau whose duty it is to centralize the said service.

The service of each of the six great railway systems is entrusted to a commission of two persons, one a technical expert designated by the railroad and accepted by the War Office (usually the Director of the system) and the other a military expert designated by the General Staff. Each of these has a substitute who represents him when necessary. In time of peace this commission is charged with the instruction of the railroad in all subjects relating to its military efficiency.

In addition there is another body which operates thru the office of the Minister of War. This is headed by a representative of the General Staff and is composed of six general officers and three delegates from the Department of Public Works. It is a consulting body and informs the Minister of War on all railroad questions bearing on the needs of the army. In time of peace the railroads form what is known as Campaign Sections for the purpose of instruction in war duties. Each of these consists of an active section and a number of territorial sub-divisions. Some of the larger systems have two of the sections, there being ten for the six systems. The active sub-division of each section, recruited from among the employes of the railroads, constitutes a corps with its own system of organization, rank, etc., and the commandant of the section is the chief of the corps. Its personnel is excused from attending the prescribed maneuver periods, but may be called out for reviews, inspections and instruction in its own special work. In case of mobilization these sub-divisions are placed at the disposal of the Minister of War who uses them in conjunction with the railroad battalions for the service of the trains in the theater of operations. Each section is composed of 1500 men (15,000 for the ten) and these with the 4000 from the railroad battalions make 19,000 specially trained railroad men immediately available. (This number has been changed during the war and the new organization is not known but the number of railroad battalions has increased from four to fourteen.)

In time of war the roads are absolutely controlled by the military authorities; as soon as the mobilization order is published, all of the railroads must place their transportation facilities in the hands of the War Department. The roads are at once divided into two zones: the Zone of Advance, commanded by the General in Chief, and the Zone of the Interior, under the direction of the Minister of War. For transport organization in the first zone, the General Staff has a director of railways who reports to the director-general of the services in rear. The General Staff of each army also has its own railroad organization. There are first the Bureau for Campaign, composed of army officers and executives of the railroad companies; then the commissions composed of one General Staff officer, one engineer officer, one commissary and one quartermaster officer, which have duties similar to those of the joint commissions described above, and lastly the chiefs of stations along the line.

This comprehensive system of organization has been successful because it was able to combine without rivalry the technical and military elements and to secure the intelligent co-operation of the two.

[Germany's Railway Strategy. By R. P. Hearne. *Sphere*, Apr 7, '17. 800 words. 5 sketch maps.]

The Germans have retired from a region served by few railways to one served by a network of lines between Lille and Laon.

The overwhelming British artillery fire along this front was causing serious casualties. It could be met either by a concentration of superior artillery or by a withdrawal. The Germans chose the latter course,

and sought by the total destruction of all cover in a belt ten to twenty miles wide to delay the re-establishment of the British artillery fire against the new line occupied.

This retreat has an instructive finality, in that it is an acknowledgment that the Germans have no hope of a great forward movement on this front. The Germans contend that the devastated zone fatally obstructs the Allied advance, but the British are the great railway builders of the world and have a magnificent motor transport. It remains to be seen what the delay will be. Taking the view that the answer to artillery fire is mobility, the German line will run from Lille to St. Quentin and Laon. Under pressure it would swing back via Guise to Rethel and via Hirson to Mézières, devastating an area at each retirement. Each line mentioned would have a railway behind it.

—Relations with Neutrals

Switzerland-Germany

[The General Staff Affair. By Col. F. Feyler. *Revue Mil. Suisse,* Jan, '16. 2500 words.]

(Colonel Wattenwyl, chief of the Information Division, was charged with having sent each evening by a military cyclist, the secret information of the general staff to the German and Austrian military attachés.

Colonel Egli, assistant chief of the General Staff, was accused of having had translated a document in cipher taken from the Russians by the Germans and which the latter had not succeeded in deciphering. A skillful cryptograph of the Swiss general staff succeeded in solving it, and the text was then communicated to the German general staff.—*Courrier des Etats-Unis,* Feb 4, '16.)

The gravest part of this affair is less the facts, serious enough, than the mentality revealed by them. One might almost say that Colonels Egli and Wattenwyl committed their faults in good faith. If it was claimed that they thought they were saving the country, we should be about ready to believe it. They forgot only one thing, that they were Swiss. Unfortunately that was the main thing to remember.

* * * * * * *

Since the beginning of the mobilization and even before, we have multiplied military mistakes. One was the nomination in August, 1914, of Colonel Sprecher to be chief of staff to the commanding general, General Wille. Each is an excellent man in his own line, but these lines are so opposed that such an appointment should not have been thought of. The general ought to have chosen a chief of staff who suited his turn of mind and his temperament. No irritating discussions have arisen, it is true, because, by tacit agreement, each has refrained from mixing in anything depending exclusively on the authority of the other. But divided responsibilities make for weakened control. Politeness cannot replace accord in mind and heart.

A preconceived idea—belief in the success of Germany—has dominated the work of the General Staff. Colonels Egli and Wattenwyl were the most imbued with this certainty and, as they are influential personalities in the General Staff, and as they enjoy, with their chief, a confidence justified by their assiduity, no counter influences save them from themselves. I would not reproach them for pro-German sentiments but for subordinating their functions to such sentiments. A preconceived idea in the domain of tactics is a strange heresy and one of the worst dangers to which a chief can succumb.

The fault is largely ours for allowing these authorities to be uncontrolled.

There are very grave consequences, both internal and international. At home there is more than a derogation of Helvetian dignity; we are ashamed, we are humiliated, and confidence is much shaken. Internationally, we, who have loudly proclaimed our sovereign independence, have lessened our credit. The protection which we asked as our right is no longer intact. We are dependent on the tolerance of the wronged party to keep out of trouble.

The remedy is to put our house in order. Weakness should give place to energy. In supreme command is needed a man to whom is given the chief of staff of his choice, and who has the will to demand this, a man who dominates preconceived ideas, gives an example of discipline, and knows how to inculcate in his subordinates respect for authority and the spirit of comradeship.

In short, let anarchy cease; in order that it may cease, men are needed. We aspire to obey but, for God's sake, let someone command.

—Sanitary Service in

See also
EUROPEAN WAR—LOSSES—SANITARY SERVICE
SURGERY, MILITARY—IN EUROPEAN WAR

Austria-Hungary

[The Sanitary Service of the Austro-Hungarian Army in Campaign. By Maj. J. H. Ford, M. C., U. S. A., Military Observer. *The Military Surgeon,* June, '17. 9000 words. 20 illustrations.]

(This article goes into so many details as to make any useful abstract practically impossible. It appeals only to medical officers.)

[General Administrative Methods, Sanitary Precautions, and Evacuation Service in the Austro-Hungarian Army. By Lt.-Col. J. H. Ford, M.C., U. S. A., Military Observer. *The Military Surgeon,* July, '17, 13,000 words. 24 illustrations.]

(A technical article, of interest, chiefly to medical officers, and dealing with a great variety of subjects. It may be noted that the "most valuable sanitary device in the Austrian Army was the rolling kitchen," that the diseases by which the Austro-Hungarian Army was most seriously menaced, were cholera, typhoid fever, dysentery and typhus, and that camp sanitation was apparently not well understood nor practiced at first.)

Great Britain

[The Collection and Evacuation of Sick and Wounded from Front to Base. By Col. T. H. Good-

EUROPEAN WAR—Continued

win, C.M.G., D.S.O., Army Medical Service. *The Military Surgeon*, June, '17. 4500 words. One illustration.]

(A lecture delivered before the Army Medical School at Washington.)

The normal daily wastage from sickness, apart from wounds, was before the war 0.3 per cent. An average of 70 per cent of the army becomes incapacitated during the first year of a war. These percentages are generally correct; yet during the present campaign, the normal daily wastage from sickness has usually been less. It is to be remarked that there is comparatively little wastage from sickness while the men are in the trenches; but when brought back in reserve, the rate goes up. The reason is obvious.

The daily sick routine is as follows:

The battalion medical officer sees the sick every morning. Minor maladies, not calling for hospital treatment, are marked "Medicine and Duty": others are noted "Medicine, Excused Duty." More serious cases are marked "Hospital," and are transferred to the field ambulance, by a motor car detailed for the purpose. After treatment here, cases are either returned for duty, or sent to the "Corps Rest Station" for convalescence, or if needing further treatment are sent further back to the "Casualty Clearing Station," which is the same as the [American] Evacuation Hospital. This system results in avoiding a considerable amount of wastage.

In respect of battle casualties, the system is as follows: Each battalion has an officer of the R. A. M. C. in charge. This officer establishes one or more "Regimental Aid Posts" in rear of his battalion, usually in a dugout, and has under his direction sixteen battalion stretcher bearers with eight stretchers. This number is frequently doubled before an attack. The post of the regimental medical officer is near or with the C. O. of the battalion: his dugout should if possible be near battalion headquarters, and also near the main communication trench that runs back toward the rear. When the battalion is ordered to attack, the medical officer should keep near the C. O. and move forward with him. If the attack succeeds, there will be a certain number of wounded in what was "No Man's Land"; the medical officer should direct such of these as can walk to go back, taking shelter as far as possible, until they meet the stretcher bearers of the division field ambulance who are coming up from behind. The wounded unable to move should be placed under shelter, in shell craters or trenches, and first aid given as rapidly as possible; they will be cared for by the field ambulance stretcher bearers on arrival. The medical officer must not stop here, but must at any cost keep in touch with his battalion and move forward with it. His presence in the newly won trenches is of moral value, and he can set about organizing a regimental aid post, improving shelters for the wounded, and so on. He should keep in touch with the field ambulance bearer division, which will now, under heavy shell fire, be clearing the wounded from the area over which the advance has just been made.

The bearer division of the field ambulance consists of 3 officers, 3 n. c. o. wagon orderlies, and 27 stretcher squads of 4 men and one stretcher each. The work of the division is both dangerous and laborious; it continues sometimes 24 or 36 hours without pause. The casualties thus collected are taken back either to the advanced dressing station of the field ambulance, or to the nearest point approached by the ambulance wagons. In the latter case, the stretchers are loaded on the wagon, empty ones taken; the men then return to the collecting area. If the casualties go to the advanced dressing station, they are further treated, and cases sorted; the abdominal are dispatched, without delay to the casualty clearing station established for them. Lighter cases are sent to the corps dressing station. Every case of wounded, no matter how slight, receives an injection of 500 units of antitetanus serum. On reaching the base, all cases of serious wounds receive a second injection.

The dressing station of a field ambulance should have a wide entrance and exit, in order to ease circulation. Buildings should be utilized if possible. The station should be close to a good road leading from the area of operation in front to the casualty clearing station in rear, and should be divided into sections for (a) receiving, recording and classifying; (b) nursing; (c) kitchen (hot drinks, soup, milk, etc., for the wounded); (d) packstore. Tents should be used if there are no buildings. Each field ambulance has 12 bell tents, and 3 operating tents.

Casualty Clearing Station

This unit is almost always near a railway station. Transportation from the field ambulances is furnished by the motor ambulance convoy. Each convoy has 4 medical officers and 18 other ranks, R. A. M. C.; 50 motor ambulance cars, 4 touring cars, 8 motor cycles, and 4 lorries (one a workshop lorry)). On arrival at the casualty clearing station, further treatment is given, many operations are made. Cases fit for travel after treatment or operation are sent by hospital train to the large hospitals on the lines of communication and at the base, where large numbers of them arrive within 24 hours after having been wounded. Formerly, many cases were sent over to England; usually cases not likely to be fit for duty or convalescent camp in three weeks were so sent. But this procedure will probably have to be modified, thanks to the enemy's practice of torpedoing hospital ships.

The stationary and base hospitals, of 400 and 1040 beds respectively, are fully equipped with the best modern apparatus. At all bases are convalescent depots, for 2000 more men. These when fully restored are sent back to the fighting line. On arriving in England, the wounded are taken by hospital train to various hospitals all over the country, and from there are transferred to convalescent "V. A. D." hospital. These convalescent homes are usually large country houses lent by their owners for the war. The government makes a small allowance for feeding. The homes are usually comfortable; a local medical man makes frequent weekly visits, and decides which men

are fit to return to duty. These men are re-examined by the R. A. M. C., re-equipped, and returned to the fighting area.

[The lecturer on the close of his lecture, answered many questions from his audience: of these questions and answers no abstract is given.]

[The Organization and Administration of the British Army With Especial Reference to the Medical Services. By Col. T. H. Goodwin, C.M.G., D.S.O., R.A.M.C. *The Military Surgeon,* July, '17. 2500 words. 2 illustrations.]

(This article gives more or less generally the administrative medical organization of the armies in the field, the composition of the various medical units, e.g. field ambulance, cavalry field ambulance, casualty clearing station, etc. An outline of duties is furnished. From the outbreak of the war until the end of November, 1916, the medical department had supplied: 37½ million bandages; 35,000 miles of gauze; 3000 tons of cotton wool; 100,000 complete medical and surgical companions, haversacks, etc.; 243 complete X-ray outfits. During three months alone, it furnished 200,000 X-ray plates and 600 X-ray tubes.)

—Submarines in

See

European war—Naval power in

Submarines—Use of in European war

—Supply and Transport

See

Motor Transport—Use of in European war

—Topography of

See also

Italy—Military topography of

EASTERN THEATER

[The Danube and Its Crossings. By E. F. *Sphere,* Oct 21, '16. 1000 words. Illustrated.]

The lower Danube is spanned by bridges at two points only—Belgrade and Chernavoda. In early times there was a bridge at Turnu Severin, but this bridge was destroyed in Roman days.

The Danube averages a mile in width above Silistria, and the Bulgarian bank is high and easily defended. Below Silistria it expands into a marshy network averaging ten miles across. The railway from Bucharest to Constanza crosses the Danube at Chernavoda. There is a bridge 500 yards long over the Borcea arm of the Danube. Then comes a viaduct eight miles long across the marshes before the main channel is reached. Here the Danube is 100 feet deep. The bridge is 850 yards long, and has five spans, the central one 600 feet long. This bridge was completed in 1895. In 1811 and again in 1877 the military crossing of the Danube was accomplished in boats. The navigability of the Danube is in the charge of the Danube Navigation Commission, comprising representatives of most of the European powers.

EVESHAM, Battle of

[The Battle and Storming of Evesham. By Percy Cross Standing. *United Service Magazine,* Jan, '17. 1600 words.]

(Historical, Aug 4, 1265. May 26, 1645.)

EXPLOSIVES

See also

Ammunition

Detonators

Marsite

Munitions

Powder

[Substitute Commercial Explosives. Anonymous. *Schweiz Zeit. f. Art. u. Genie,* May '16. 4000 words.]

(A transcript from *Zeit. f. d. ges. Schiess and Sprengstoffwesen.*)

Due to the difficulty to getting dynamite all quarrying must now be done with substitute explosives, usually chlorate high explosives such as koronite, permonite, roborite, prāposite, albite, barbarite, etc. With a view to disseminating information concerning the proper use of these new explosives the Quarrymen's Guild of Germany has gathered from its members and published in a pamphlet a number of practical hints and instructions on the use of the foregoing explosives for various purposes.

[Nitro-Starch as an Explosive. By S. S. Sadtler. (*Metallurgical and Chemical Engineering,* vol. xvi, No. 7, p. 361, Apr 1, '17.) From *Journal Franklin Institute,* May, '17.]

The application of high explosives to mining and general commercial purposes may be said to date from the discovery of Nobel that nitroglycerin could be absorbed in kieselguhr and then handled with a sufficient degree of safety to warrant its use. The product was called dynamite, but this name now applies broadly to nitroglycerin absorbed by other inert material, like sawdust, mica-powder, etc., and other mixtures as well, but also it applies to various high explosives containing no nitroglycerin. At present there are an indefinite number of chemical mixtures aiming to meet the different working conditions. By the solution of guncotton or nitrocellulose in nitroglycerin (in which it readily dissolves, forming a jelly-like mass) we obtain blasting gelatine and gelatine dynamites and mixtures of these with other ingredients. Gun-cotton (or the higher cellulose nitrate) has not been found applicable by itself for the field of commercial blasting and mining explosives, except for submarine blasting, where the compressed gun-cotton finds a use, as it is too bulky in comparison to its weight for other work.

An earnest effort had been made for some time to find a satisfactory substitute for nitroglycerin dynamite, but without success until recently, when great improvements were made in the manufacture of nitrostarch and a suitable container found for its use. Starch, which has an analogous chemical composition to cellulose and forms corresponding nitrate esters, was early suggested as the basis of a high explosive, having all the advantages of cotton without its bulk or higher cost. For blasting, this material has great many advantages. It cannot be exploded except by exploding a cap in contact with it, it gives off no bad fumes, is non-freezing, and appears to have good stability, a quantity stored for ten months showing no deterioration. One of the chief points of merit in the

EXPLOSIVES—Continued

use of nitro-starch is its cost. As there is no special difficulty in its manufacture, it can readily be seen that, being made from a base costing 2⅛ to 2¼ cents a pound, as compared with glycerine at 30 to 60 cents a pound, or cellulose rising to 10 cents, there is great economy in its use. Quite apart from the cost of bases, but for reasons of simplicity of handling and time of nitration, it promises to be more easily and economically manufactured than nitrocellulose.

—Manufacture of

[Note. *Army & Navy Jour.*, July 14, '17. 250 words.]

The development in the manufacture of explosives in the United States is shown by a recent report of the Bureau of Mines, Department of the Interior. In 1913, a normal year, the value of exported explosives was $5,521,077; in 1914, $10,037,587; in 1915, $188,-969,893; and in 1916, when the whole industry had been thoroly organized, $717,144,649. The total production of explosives in the United States in 1916 was 252,708 tons.

[Even the Dead are Useful in German Defense. From the *Mercure de France*, Mar 16, '17. 400 words.]

The *Chemicher Zeitung* in its issue of Nov 18, 1916, contained the following advertisement: "Owing to the departure of our manager, we have a vacancy for an engineer, not liable to military service, to take technical and commercial charge of our factory for the *destruction of cadavers.*" The name of the factory, *Thermo-Chemical Mill,* leaves no doubt as to its purpose; that is, not only are bodies destroyed by heat, but they are chemically treated and utilized. The purpose of the treatment is the production of glycerine. [This statement has appeared from various sources. It has, however, been also repeatedly and more authoritatively denied.—ED. MIL. DIG.]

[Would It Be Advisable to Establish Manufactories of Powder and Explosives in This Country? By Capt. Müller. *Revista Militar,* Jan, '17 (Argentina). 1400 words.]

In deliberating upon this question the following advantages incident to the fabrication of powder and explosives within the country should be considered:

(a) Argentina would be independent of foreign importations. The articles being contraband of war, importations during war time could not be relied upon.

(b) The State would not suffer from speculations which, with the fluctuations of markets, impose at times exaggerated prices upon this class of war material.

(c) The products would be obtained at a cheaper rate than that usually paid to foreigners.

(d) The inconvenience of keeping on hand great stocks would be avoided. This inconvenience is a serious one as, 1st, the capital represented is dead; 2d, some explosives deteriorate when kept in storage for a long period and the stock would therefore have to be renewed from time to time; 3d, new discoveries are constantly leading to innovations and substitutions in these supplies.

(e) A trained personnel would be secured.

(f) The money now spent abroad would remain at home.

Finally and most important, Argentina should be self-sufficient in the obtainment of articles so vital to national defense.

The conclusion is that the factories should be established.

FEET

—Care of the

See also

"TRENCH-FOOT"

[Making the Feet for Military Service. By Captain Arthur S. Jones, M.O.R.C. *The Military Surgeon,* Aug, '17. 3500 words. Diagram, tables.]

The soldier's foot is in a military sense, one of the most important parts of his anatomy. At recruiting stations, select men with normal feet and those having only minor defects of the foot. The regulation army shoe is admirably constructed; officers and men should wear no other, nor should they accept any modifications or imitations. The sock should be four sizes larger than the number of the shoe: a number seven shoe should take a number eleven sock.

A foot with minor defects should be accepted, because it may be improved, but a foot with major defects can not be made strong and serviceable. [Exercises are described for the development of the foot, and rules given for the care of shoes. G. O. 26, Series 1912, dealing with the subject of feet and shoes is reprinted in full. A considerable portion of Captain Jones' article is technical, and addressed rather to the medical than to the line officer.]

FENCING

—Bayonet

See also

BAYONET—INSTRUCTION AND TRAINING

FIELD ARTILLERY

See also

COAST DEFENSE—BY MOBILE GUNS

Austria

[Condition of the Austrian Field Artillery Just Before the Outbreak of the European War. By Captain Matsumura (taken from his lectures before the Military Officers' Club of Tokyo). *Kaikosha Kiji,* May, '16. 1000 words and three diagrams.]

(This article is divided into five chapters dealing with the numbers, variety, formations, officers and organization of all the artillery in the Austrian army. It is a technical article.)

Sweden

[The Swedish Artillery. Anonymous. *Schweiz. Zeit. f. Art. u. Genie,* July, '16. 7500 words.]

The present war has again shown what every war before it has shown, that the best chances for success are

on the side with the most powerful guns. On the other hand, the heavier the material the smaller the chance of withdrawing it safely in case of defeat. In providing for the organization of its Field Artillery, Sweden has kept these things in mind; nevertheless, there is a conviction to-day that more heavy artillery must b: provided.

Under the old law, the Swedish Light Artillery was composed of 57 light gun batteries, 3 horse batteries, 12 light howitzer batteries organized into six regiments and one independent battalion. A regiment was composed of 3 light gun battalions of 3 batteries each and 1 light howitzer battalion of 2 batteries. A regiment was assigned to each of the six tactical divisions: the horse battalion to the cavalry division, the independent battalion to the insular detachment on Gotland.

The Swedish Heavy Artillery cannot be considered sufficient. It is armed with 12 cm. guns and 15 cm. howitzers. The number of batteries is unknown, but a new bill has just been proposed in Parliament appropriating some three million dollars for Heavy Artillery, hand grenades, trench mortars, mine equipment, barbed wire, trench shields, periscopes and field illuminants.

Swedish political aspirations practically commit it to a defensive war, and that against Russia. To this end, all her plans, preparations and distribution of troops have been made. It is therefore proposed also to increase the number of field guns, and to assign one machine gun company to each infantry battalion.

The opinions of Sweden's military experts seem to indicate that they consider the light field gun of great importance on the defense, but that the howitzer is the weapon par excellence for attack. The present war has also shown Sweden that a nation must be self-sustaining in order to have any hopes for success. Sweden is therefore taking every measure to develop her military resources. As far as possible, all ordnance construction will be done at Bofors.

United States

[Note. *Army & Navy Jour.*, Mar 3, '17. 225 words.]

The 3-inch rapid fire piece will continue to be the main reliance of the U. S. Field Artillery. The principal feature of the new design is the "split-trail," an invention of a colonel of the French Army. This enables the piece to be elevated to sixty degrees, when it becomes a small howitzer and an auxiliary to anti-aircraft defenses. This gun can be laid more rapidly than the similar German weapon, but not as rapidly as the French "seventy-five." However, it surpasses the French gun in other details, in the opinion of army officers.

—Ammunition—Consumption of

[The Problem of Munitions and of War Material in the Coming War. By Lt.-Col. Ernesto Medina F., General Staff. *Mem. Del. Ejército,* (Chile), Jan, '17. 5600 words.]

The present war has brought out the fundamental principle that the infantry advance is normally ineffective unless it is solidly prepared and supported by artillery fire. To-day, the infantry gains its victories thru the co-operation of the artillery, after the latter has paved the way by means of an intensive fire action. For this, the consumption of large quantities of ammunition is absolutely necessary.

The covering masses and the elements employed to protect the troops require a potential action of destruction in order to dislodge the enemy so as to engage him in battle.

At the beginning of the war, the German infantry suffered great losses because the attack was undertaken before the artillery had broken down the enemy's resistance. The attack was launched according to the then existing principles. Reverses caused a change of this system.

Decisive actions only come after days, nights, weeks and months of incessant and persevering engagements. In the war which is being waged on European soil, one can read of many instances wherein it has taken many months to advance even half a kilometer.

In comparing the expenditure of munitions during the wars of 1870-71, Russo-Turkish war, Manchurian war, Balkan war, and the present war, which is being fought to win the economic supremacy of the world, we have the following:

1. In the war of 1870, there was an average expenditure of 170 rounds per cannon. In the Russo-Turkish the maximum consumption was 180 rounds.

2. In the Manchurian war, the Russian batteries fired from 522 to 848 rounds per cannon. During the battle of Mukden, the Japanese consumption of ammunition averaged 600 rounds per piece; the maximum was 1400 rounds.

3. In the short Balkan war, the Bulgarians had, at the beginning of the war, a supply of 1000 rounds per cannon. At the end of the war, there were left about 40 rounds per gun.

The experience gained in this war induced Bulgaria to increase the allowance of ammunition to 1500 rounds per gun. In addition, provisions were made for the erection of ammunition factories.

4. German, French and English reports agree that without the enormous consumption of ammunition demanded of the artillery, the advance of infantry is impracticable. At the beginning of the war and in a few hours, the Germans fired 100,000 rounds along a front of eight kilometers, or about 2½ times more than the amount of ammunition fired at the battle of Saint Privat, which was the battle of greatest intensity of artillery fire during the war of 1870-71. To the north of Arras, in 24 hours, the French fired 300,000 rounds of artillery ammunition, or more than one-half the number of rounds used by the Germans during the entire 1870-71 war.

During the first two months of the battle of Verdun, there was consumed so much artillery ammunition that it resulted in the unheard-of proportion of one artillery projectile for every three shots fired by the infantry.

According to the *Artilleristische Monatshefte,* during the first phases of the present war, the losses were in the following proportion:

FIELD ARTILLERY—Continued

60.8 due to artillery fire.
31.8 due to infantry fire.
7.4 due to other causes.

At the battle of the Marne, even in the infantry engagement, 90 per cent. of the losses were the result of artillery fire.

It may be said that artillery fire incapacitates at least two men while rifle and machine-gun fire incapacitate scarcely one man.

During the Russo-Japanese war, the losses caused by artillery and infantry fire were 22 per cent. and 1 per cent. [?—Ed.], respectively. Now, the effect of artillery fire is twenty times greater than that of infantry. This is due to the greater professional ability of the modern artilleryman and to the enormous and unlimited expenditure of ammunition which constitutes the fundamental characteristic of the tactical and technical development of modern artillery.

Government-owned arsenals and factories cannot supply the munitions, arms and war material that modern warfare demands. It is necessary to utilize private-owned factories, consequently steps should be taken to organize, during peace times and within the country, all manufacturing plants which, in times of war, can be converted into manufacturing plants for munitions and war material.

Besides the government-owned arsenals, Germany has the large factories of Krupp, Rheinische Metallwaaren (Ehrhardt) and Thyssen. In addition, there is a large number of other factories of lesser importance.

During the war, the Krupp plant has increased the number of its workmen from 87,000 to 242,000. The Ehrhardt factory has increased from 40,000 to 100,000, and the Thyssen factory from 30,000 to 80,000.

The demand for ammunition, the replacing of cannon, rifles, machine guns, etc., have been such an important consideration that the Allies have been compelled to entrust all this work to a "Minister of Munitions."

A country which does not maintain in time of peace an organized national supply of munitions and war material is in no position to conduct a campaign along the present scientific lines, nor does it have the probability of gaining a victory.

The military organization of Chile lacks one technical military organ: nationalization of the military industries.

For arriving at a basis for the probable consumption of artillery ammunition, it would be best, taking into account our resources, to start with a force equal to 6 per cent. of the population. In the Balkan war, Greece, Bulgaria, Serbia and Montenegro enrolled 15 per cent. of their population. Germany and Austria have exceeded the 10 per cent. basis.

The proportion of artillery may be taken as eight guns for every 1000 rifles. It is believed that in the future the proportion will be 10 or more guns for every 1000 men.

—Ammunition—Shrapnel

See
SHRAPNEL

—Ammunition—Supply Service

[How the Shells Reach the Gunners on the Western Front. *Sphere*, Mar 10, '17. 200 words. Illustration and note.]

With the thaw came difficulties for the transport service, but the guns must have shells. Motor transport is helpless in the soft mud, and the use of horses had to be resorted to. The shells are placed in leather holsters hanging on each side of the saddle. Only a few can be carried by each rider (the drawing shows eight), but a constant supply is assured.

—Combat

[From the Great War—Two Batteries in the Arras Battle. From the *Norddeutsche Allgemeineine Zeitung*. *Schweiz. Monatschrift aller Waffen*, Sept, '17. 700 words.]

Telephonic communication with the group had been broken about 11 a. m. The last information had been that the enemy had reached the third position, and a barrage was ordered. The battery was now on its own responsibility. It was only 150 meters from the enemy. Infantry fire was opened on the battery from a wood on the left. One gun was turned on the wood. Another jammed. Two continued the barrage. After an hour the four are again working together to help the infantry. That is the modern rôle of artillery. In the afternoon the hostile fire slackened—the enemy artillery feared that they would injure their own infantry. The battery commander sends a messenger to the limbers for ammunition. He also assembles some straggling infantrymen and arms them from a dugout. At four o'clock a hostile flyer appears and directs fire upon the battery. Still the limbers do not come. At six o'clock a snowstorm adds to the difficulties of the exhausted personnel. Another messenger is sent for the limbers. At eight o'clock they arrive. The guns are moved to the rear. They pass an abandoned battery. Can these guns also be saved? The horses are too exhausted to draw the double load. The abandoned battery is manned, fires all its ammunition, and is then blown up. The other battery proceeds.

(To be concluded.)

—Defense Against Aircraft

See also
ANTI-AIRCRAFT ARTILLERY

—Fire

[Adjustment of the Height of Burst with Field Guns. Anonymous. *Schweiz. Zeit. f. Art. u. Genie*, Mar, '16. 2500 words.]

1. Under ordinary conditions a corrector of from 12 to 14 will bring the time and the burst range in proper accord at all ranges over 1500 m.

2. Since the conditions of transport and storage of ammunition cannot be made uniform for all places, it is but natural to find a certain amount of dispersion in firing.

3. Further dispersion is produced by the effect of

barometric pressure, density of the air and elevation above sea level, upon the time train of the fuse and the trajectory.

4. When firing takes place at great altitudes, and also when an abnormal angle of site is used, the discrepancy in the fuse increases with the range. A knowledge of the causes of these variations will make it quite simple to apply the proper remedy in applying appropriate corrections to both range elevation and corrector setting.

5. Care must be taken to separate the errors due to ordinary dispersion and those due to discrepancy in the fuse setting. For instance, when firing in extreme cold, the discrepancy of the fuse may be very large whereas the dispersion for a group of shots will always be the same.

[Adjustment of the Height of Burst with the 7.5 cm. Gun. By Maj. W. Luder, Swiss Artillery. *Schweiz. Zeit. f. Art. u. Genie,* May, '16. 1000 words.]

(Since the outbreak of the European war the Swiss army has been mobilized. The field artillery has conducted its firing practice near the front. The article gives information on the adjustment of the height of burst for different altitudes for both the light field and the mountain guns. The proper corrector to be used at different altitudes and at different ranges is shown graphically. It will be noted that the corrector for a normal height of burst increases directly with both the altitude and the range.)

[Ranging From an Observation Post to a Flank. Anon. *Jour. Royal Artillery,* July, '16. 2000 words. 4 figs.]

Ranging a battery from an O. P. to a flank has from the beginning of the war, been regarded by many B. C.'s as one of the most difficult operations they are called upon to carry out. Many schemes have been put forward and possibly a satisfactory solution has not been found yet, as most B. C.'s adopt any expedient rather than range the battery from an O. P. on the flank.

In ranging from an O. P. on the line of battery and target, the B. C. first corrects his deflection to get on the line of gun and target, and then with succeeding shots proceeds to bracket the target by noting whether it is concealed by or silhouetted against the smoke of bursts.

The procedure from an O. P. on the flank is similar, the B. C. correcting the range or deflection of the first shot, to bring the second on the line O. P.-target, and thereafter bracketing on that line by appropriate changes of both elevation and deflection. The observed deviations must be corrected by factors easily determined in advance, depending upon the angle between the line of fire and the line of observation.

An important point to remember is to repeat any shot which does not appear to respond to corrections previously made, and after once getting on the line no correction should be made until two or more rounds establish the fact that further correction for line is necessary.

If the angle between the line of fire and the line of observation is small, it will be found better to get on the line of observation by changing the deflection, and then bracket by altering the range, making the necessary consequent changes in deflection to keep on the line of observation; but if the angle is large, it is better to get on the line by changing range and then bracket by changing the deflection, with the attendant changes in range to keep on the line.

Examples are given illustrating how to calculate the factors for correcting observed deviations.

[Enfilade v. Frontal. By Captain S. R. Wason, R.F.A. *Jour. Royal Artillery,* Aug, '16. 750 words. Illus.]

A few notes to urge the value of enfilade fire as opposed to frontal fire, especially in trench warfare.

(1) The proportion of three flat trajectory guns to one howitzer in the field artillery of a division, throws an undue proportion of incidental shooting on the latter, owing to the ease with which parapets can be constructed to guard against the fire of the former.

(2) Infantry who have experienced enfilade fire know the difficulty of making buttresses sufficiently high to protect the whole of a bay.

(3) The accuracy of guns for line is greater than for range.

(4) As range increases so do the 50 per cent. zones, but the breadth zone remains small.

(5) Fire against trenches being attacked can be kept up longer.

(6) High explosive shell fire will be more effective if the 50 per cent. zone lies along the length of the trench.

(7) Field gun and howitzer shrapnel bullets search a trench more effectively if the angle of fall is at least 30°. If the two trench lines are parallel, this would double the range.

(8) Shrapnel shells cut entanglements more effectively when crossing the wire at an angle.

(9) Difficulty of getting concealed positions for guns to fire to the front.

(10) Infantry lookouts are slower to pick up guns to a flank than those in their front, and take greater pains to assist in finding the gun that is shooting at them.

(11) Guns are no more immune from hostile fire at 2000 yards than they are at 1000 yards.

(12) The disadvantages are the increased length of line of communications, and the laying of additional wire to keep touch with the troops. But in trench warfare these may be overcome easily.

[A New Table of T. O. B. Corrections. By 2nd Lieut. C. P. Wright, 31st Northumberland (N. Riding), R. G. A. *Jour. Royal Artillery,* Aug, '16. 250 words. 1 table.]

In calculating the apex angle of a T. O. B. triangle, it is necessary to correct for the inclination of the base OB to the line OT.

The old rule, tho accurate for angles near 30°, is not accurate for other angles.

FIELD ARTILLERY—Continued

To meet this, another scale of fractions has been drawn up which are given in tabular form, together with a comparison of the per cent of error by both rules, for each 10° from 0° to 90°. These fractions may be remembered easily by remembering two simple rules.

For exterior angles at O of 10, 20, 30, and 40 degrees, the fractions are the ratios of these numbers to 60, as, 1/6, 2/6, etc.

For angles of 50 and 60 degrees, the fractions are built up of the four consecutive numbers 3 and 4, and 5 and 6, as ¾ and 5/6.

For angles of 70 and 80 degrees the fraction is one.

[Practical Instruction in the Conduct of Field Artillery Fire, for Use Indoors and in Garrison Schools for Officers. By Captain Carlos Millan (Artillery) General Staff. *Mem del Ejército* (Chile), Mar, '17. 1500 words. With sketches.]

The writer has originated a device which, in the absence of actual firing, gives a very comprehensive idea of the different steps connected with artillery firing, such as estimation of the range, the bracket, height of burst, etc.

This device consists of a blackboard on the upper edge of which slides a wooden box. A wooden ruler about five meters long slides inside of this box, and is graduated into meters and fractional parts. Each meter represents one kilometer.

A wooden bracket is attached to one end of the ruler. This bracket has four openings, thru each of which passes a cord carrying at one end a weight covered with cotton to represent the shots.

A table five meters long and covered with cloth is placed against the blackboard. The cloth when folded up may be made to represent the various accidents of the terrain. The firing battery is outlined by four toy guns placed on a convenient location of this outline of the ground.

Opposite the blackboard and one meter away from the table sits the officer who is to direct the fire of the battery. Behind the blackboard and connected with the box which holds the graduated ruler, there is attached a board about two meters long. This board has four perpendicular rows of tacks, at regular intervals with graduations marked on the side. Each tack represents a division of the corrector. When the four weights corresponding to the four guns of the battery are in their normal position, the cord is fastened to hooks placed at the bottom of the row of tacks.

The working of this device may be illustrated by the following example: It is intended to fire a battery using a range of 3000 meters. This distance of 3000 meters is measured to scale from the place where the officer conducting the fire sits to the objective which is given by the director of the war game. The officer conducting the firing, by using his field glasses reversed, estimates the range to the objective, gives the estimated range to an officer who is behind the blackboard and who slides the graduated ruler until the given range can be read. When the certain gun has been directed to fire, the officer back of the blackboard releases the corresponding weight until it touches the surface of the table representing the terrain, allows it to remain in this position for a few seconds, then brings it back to the normal position. If the weight has fallen in front or behind the designated objective, the officer conducting the firing must give the necessary correction for range, the necessary adjustment being made by the officer behind the blackboard by sliding forward or to the rear the graduated ruler. After the bracket has been established, the weights are brought to the normal position and kept so by fastening the cords to the lower row of tacks. When the officer conducting the firing gives the height indicated by the corrector, the officer behind the blackboard releases the proper weight until the tack corresponding to the height indicated by the corrector is reached. Necessary corrections for the height of burst are made as indicated by the officer conducting the firing.

—Fire—Adjustment of Angle of Sight

[A Method of Obtaining the Angle of Sight BT in a TOB series By a Single Setting of the Slide Rule. By Capt. Randal Casson, Indian Army (R. of O.). *Jour. Royal Artillery*, Jan, '17. 1200 words. 1 fig.]

This is a mathematical discussion of the above subject and cannot well be digested. See complete article.

—Fire—Over Friendly Troops

See also

INFANTRY—ATTACK (Article: The Infantry Advance as Related to Artillery Fire.)

—Fire Control

See also

SMOKE SIGNALS

[Masses of Artillery. By Alfonzo Barra, Captain of Artillery. *Memorial de Artillería*, Nov, '16. 3200 words.]

Modern military operations, given the forces and weapons employed, require the control of large masses or units of artillery. This control must be exercised by a single individual and must be as simple and effective as the control of a battery by its captain.

It may be stated that up to the present time this problem has not been solved, and even in the present war large masses of artillery are controlled by very crude methods.

The system proposed is based on a triangulation to be made on the ground by means of a "plotter" or plane table device, the invention of Colonel of Artillery, Marqués de Casablanca.

This system is applicable in two general cases: one in which an offensive is initiated or which progresses slowly; the other, one in which a stubborn defense with successive lines of resistance is contemplated. Having studied the ground and examined the fronts of probable attack, a distribution of the mass of artillery is decided upon. It remains then to prepare the position and to make the triangulation upon which the control is based.

If a large scale map is available, the work will be facilitated. The entire front is covered by a primary

triangulation system. The vertices are selected in a manner so as to conform to the degree of accuracy desired and with a view of later tying up the battery positions to the general or primary system. Having completed the chain of triangles, a base connecting one side of the system will then be measured. The orientation of the system is then accomplished by determining the direction of one side and from that any other.

The battery positions are then tied up to the primary system by means of the intermediate vertices. The next step is to fill in the primary system, thus forming a secondary system of triangulation connecting each unit to all points of military importance.

Tracings are then made of the finished work, which are furnished each unit and by means of which firing data are determined. On the sheet of the commander of the mass suitable direction lines are drawn, including a circle graduated in mils. All of the above having been completed and the lines of communication established, the commander of mass holds in his hands an accurate and flexible control.

[The Use of Perspectives in Batteries of Position. By Eduardo Aguirre, Captain 5th Mounted Field Artillery. *Memorial de Artillería,* Dec, '16. 2500 words.]

The constant progress which has been made and more especially at the present time, in artillery, has been the cause of greater complications in the elements which constitute the armament and as a result the means employed for its use.

In periods not very remote, the handling of artillery was so simple as to require only a rudimentary knowledge. To-day on the contrary even the preliminary calculations are complex and very difficult to make.

The solution of the problem and the responsibility for the results obtained are functions of the director of fire, the captain or major if treating of battery or group as the case may be.

From the moment a target is indicated to a captain, it is his duty to open fire, not only with the greatest accuracy possible, but with the greatest celerity. The determination of the firing data as well as the fire for adjustment represents a loss of time and in many cases so considerable as to render the action of the battery of doubtful utility when firing on moving targets.

In field batteries, with a well trained personnel of much practice, the initial firing data can be obtained with great rapidity, but in batteries of position and coast batteries the loss of time is considerable and it is with these that we are going to discuss the idea of simplifying the work of the captains and officers by means of artillery perspectives.

We will study the problem in general terms and without special reference to any particular class of matériel. The simplification which we believe can be introduced applies solely to batteries with fixed sectors, land or sea. The application of the method is not practicable to mobile or field batteries nor to coast batteries covering sea sectors only.

The ideal of every captain should be upon opening fire on whatever class of target, to know beforehand and without any calculation, the exact range of the target, the angle of site, the approximate front of the target, the deflection with respect to such auxiliary targets which may be used, and the character of the target, in order that the proper projectile may be selected.

Mobility and lack of stability are the principal characteristics of field batteries, with the result that it is impracticable to determine in advance firing data of any kind, as the sites that may be occupied are unlimited in number. In the case of fixed batteries or batteries of position, the conditions are entirely different and it is indispensable that as much firing data as possible be determined and ready for use in advance. The field of fire being always the same, the data determined should include: ranges to distinct targets of probable strategical importance, angles of site corresponding to the same, auxiliary targets, deflections of distinct points which may be used, nature and disposition of obstacles, etc., etc. All of the above collected in an artillery perspective of the sector of the battery, practically solves the problem or at least very much facilitates its solution, giving the captain the firing data in a graphical and rapid manner. The command of batteries would be thus simplified without loss of accuracy and would enable officers only recently assigned to the battery and not well acquainted with its matériel to conduct its fire without difficulty.

In the Melilla campaign of 1911, the 3d Mountain Battery of the then mixed regiment of artillery, in September, was marching as a part of a column on Ishafen. After the battle of the 12th, the battery received orders to take up a position in South Ishafen. On the 14th it was the belief of the captain and battery officers that the position would be occupied for some time as was actually the case. The writer of this article, convinced of the ideas which have been expressed, employed his time in determining ranges to settlements, woodlands, Arab villages, fords, roads and battery crests, also the angles of site and deflections with respect to three auxiliary targets. This was done without even making a perspective, but arranging the data in the form of a pocket table.

It was soon seen that the work was not useless, for in the battle of the 20th of September, the battery delivered its fire with precision and rapidity, using the data determined days before, calmly and with accuracy. On the 14th of October, the same data were used in firing the few shots fired on that date.

A perspective carefully made would have very much facilitated the direction of fire, for a panoramic sketch thus executed is a photograph of the terrain, giving all the details of interest.

In the preparation of a panoramic view of the sector, it is believed that the best results will be obtained by use of the battery observing instrument. There is thus insured a greater accuracy in plotting prominent points and noting the distance between them in mils, an accuracy which cannot be obtained by use of the ruler. The method used is as follows:

Set up the battery telescope over a point determined from the battery, levelling it carefully in order that

FIELD ARTILLERY—Continued

the plate shall move in the horizontal plane. Direct the telescope at the extreme left of the battery sector and plot this point on the cross-section on which the preliminary sketch is to be made. The scale adopted should be the normal one as prescribed by the School of Fire, but may be varied to suit the case. In order to fix ideas, we will adopt the scales of one-half centimeter equals 20 mils horizontal and 40 mils vertical.

The point of origin being fixed and plotted, swing the telescope from left to right taking readings on distinct points which by their importance may be useful and noting the horizontal angles or deflections and the angles of site.

The principal points now being plotted, they will be united by lines which indicate the crests between them. Roads, fords, draws, etc., are plotted in a similar manner and by direct inspection. All of the above should be done in the most careful manner in order that the panoramic copy be as exact as possible. The work will be completed indoors, adding all details which indicate the character of the terrain, such as railroads, bridges, woodlands, rivers, telegraph lines, etc., and giving to the different zones suitable colors, indicating by shading the proper relief.

Each one of the points which may be used as an auxiliary target is then market by a capital letter, A, B, C, D, etc., and probable targets by small letters, a, b, c, d. etc.

Sufficient margin will be left at lower edge of the sheet in order to note thereon the data corresponding to each of the probable targets. These data will be as follows: range from the battery, to be determined at the same time as the other data by the usual methods; deflection with respect to each one of the auxiliary targets; and the angles of site corresponding.

(An illustration of a typical perspective accompanies this article, and its use is shown by an example.)

France

[The French Artillery. Reprint from *Boletín de Informacion. Memorial de Caballeria,* Jan, '17. 1300 words.]

At the beginning of the great war, the French artillery equipment was inferior to the German. The famous "75" field gun was better than the corresponding German 77 mm. gun, but this was a misfortune in that the French were misled by the merits of their gun into regarding it as a satisfactory substitute for field artillery of all kinds. In August, 1914, the French went in the field without light howitzers and without sufficient heavy artillery. The Germans, on the other hand, were abundantly supplied with various calibers of heavy pieces, each of which fulfilled a predetermined rôle.

A mistaken spirit of economy also had prevented the accumulation of the proper quantity of ammunition. The science of the officers, abnegation of the soldiers, and the excellence of the matériel were so marked, however, that the enemy looked with terror upon the artillerymen of the Republic and characterized them as "black butchers."

The French have overcome their inferiority in artillery and now confront the enemy with an unlimited number of cannon of the greatest power. In April, 1915, M. Millerand stated before Parliament that the output of projectiles of all calibers came to 600 per cent of the amount thought ample at the beginning of the war and that it would shortly come to 900 per cent of this amount.

He also stated that the number of heavy batteries had been multiplied six fold. The curve of increase in the construction and repair of matériel for the guns of various calibers is equally amazing. The following list, tho incomplete, indicates the diversity of calibers used:

Guns for the Trenches

Trench mortars, (*crapouillots*) which throw small bombs.

Mortars of 150 mm., throwing bombs of 15 kilograms.

Mountain guns of 58 and 80 mm. which throw aerial torpedoes of from 58 to 105 kilograms, the explosion of which opens holes of 8 meters in diameter and 2½ meters in depth.

Field Pieces

Rapid fire mountain guns, 65 mm.
Rapid fire field guns, 75mm.
Rapid fire field guns, 80 mm.
Rapid fire field guns, 90 mm.
Rapid fire field guns, 95 mm.
Rapid fire field guns, 105
Rapid fire field guns, 120 short.
Rapid fire field guns, 120 long.
Rapid fire field guns, 155 short.
Rapid fire field guns, 155 long.

The above pieces fire projectiles of from 6 to 70 kilograms to ranges of from 6 to 16 kilometers.

Siege Pieces

220 mm. mortars.
240 mm. mortars.
305 mm. guns.
340 mm. guns.

These pieces fire projectiles from 105 to 400 kilograms, to ranges of from 15 to 40 kilometers.

Lastly a monstrous cannon which surpasses the 420 Krupp and 380 Skoda. Without going into details, it is enough to say that this new piece measures more than 20 meters in length. To the above list could be added the marine guns of all calibers which the French are using in their fortifications.

—Fire Control—Aeronautic

See also

KITE BALLOONS

[Artillery Observation: Means and Expedients. By H. Schmiterlöw. *Artilleri-Tidskrift,* Parts 1 and 2, '17. 5400 words. 4 illus.]

The experience obtained from our own field maneuvers as well as the reports from the world-war show that the artillery cannot be effectively fought by using only directing stations located on the ground. The fire of the heavy artillery, both German and French, is now

directed from the air. The necessary information is given to the batteries by means of the wireless telegraph and the camera, the first principally for fire direction, and the latter for reconnaissance work and for locating the enemy's guns. It is not enough to photograph the enemy's position many times and make maps from these photographs, but in the preparation for an attack, a daily supplement must be made to these maps showing the effect of our own fire and the changes in location of the enemy's guns. In case our own aircraft are not superior to those of the enemy, recourse must be had to captive balloons and observation kites flown over our own lines. The former can be used only when there is very little or no wind, the latter require quite a strong wind in order to rise.

The work of taking the necessary photographs of the enemy's positions and mapping them on a large scale requires a carefully trained corps of officers, draftsmen, and enlisted personnel. Sometimes these photographs have to be taken at night when the enemy is firing in order to discover the position of his guns by the flashes as they are fired.

These photographs are compared with those taken during the day. The fall of our own projectiles is also observed from balloons or kites, and the necessary range corrections made.

Another method of range finding is by taking the time that elapses between the flash of an enemy's gun and the report. Knowing the velocity of sound, the distance to that gun is thus determined. In this case allowance must be made for the direction and velocity of the wind, moisture and temperature of the air, barometric pressure, etc. The investigations and formulas relative to the influence of the air conditions on the velocity of sound made by the late Norwegian meteorologist Mohn, have been employed.

The seismograph has also been made use of for artillery purposes, and by means of it the calibers of the enemy's guns, as well as their number, can be ascertained while they are firing.

Before the war, observation ladders for the field artillery were in use, but not so much lately owing to the limited height to which the observer could get by means of them and to his exposed position.

Observers placed in or near the most advanced trenches are now universally employed. These observers should whenever possible be on high points, and when practicable up in trees from which a good view can be obtained, and where the observer is not liable to be discovered.

During "drum fire" dependence cannot be had on the telephone, and optical signals must be resorted to. Communication by means of the wireless telegraph or telephone is also now considered necessary. Hyposcopes and mast telescopes (the telescope at a height as great as 15 to 25 meters) have also been used. Illuminated artillery projectiles have also been employed to some extent to determine range.

[How to Range with Aeroplane Observation. By N. C. T. *Jour. Royal Artillery*, Aug, '17. 1000 words.]

The application of exact corrections as sent in by the airplane observer is condemned as the word of the observer is only approximate and not to be relied upon too closely. The "Artillery dial range corrector" (which is in use in our service as well) divides an error into its range and deflection components, but when these corrections are too closely applied the result is usually erroneous. Using the clock system, the observer merely indicates the hour and is therefore liable to an error of half an hour or fifteen degrees on each observation. In addition to this observers claim that errors of an hour, or thirty degrees, are liable to occur in their locating the burst. Thus it is possible that there may be an error of forty-five degrees in the direction of the burst from the target. The range circles are graduated so that the "A" circle is fifty yards. All others, however, are the even hundreds so the observer is likewise liable to an error of fifty yards on each observation as he indicates only the nearest hundred. Their judging of distances is also inaccurate so another error in distance must be considered.

To apply an exact correction is therefore folly, and if this is so, an elaborate instrument to plot the observation accurately is unnecessary. The Battery Commander should bracket for range and line. As a general rule, he should only correct his line if the round is more than an hour out in direction, and his elevation if the round is more than an hour out for range.

[Directing Artillery Fire by Night and Day Signalling to and from Aircraft. By Henry Woodhouse. *Flying*, Sept, '17. 2200 words. Illustrated.]

Aircraft are the necessary adjuncts of coast and field artillery and the aero observer is the man behind the man behind the gun. Airplanes and captive balloons are used for spotting artillery fire. The observer has to perform two functions. First he must locate the target, which may consist of hostile batteries, bodies of troops, advanced trenches, trains and mechanical transports bringing supplies or reinforcements to the enemy, temporary headquarters, or strategic positions held by the enemy. Having discovered the target the observer directs his battery to open fire and then notifies the gunners of the effect of the fire by wireless, if from an airplane, and by telephone from a kite balloon.

While looking for the target the aviator may have to fly down low. As soon as he has found the target he flies to whatever height is necessary to avoid crossing the trajectory of the shells.

The aviators co-operating with the artillery are usually located at an aerodrome located from 10 to 15 miles behind the firing lines and are instructed to be over a given place at a certain hour to spot the firing. From a height of 4500 to 6000 feet the observers can see clearly the effect of firing of large calibre guns, but the firing of three-inch guns is very hard to detect. While spotting artillery fire the aeroplanes usually fly in figure 8's and circles, changing their direction as often as possible, so as not to allow the men behind the anti-aircraft guns the chance of anticipating what

FIELD ARTILLERY—Continued

direction they will fly next—because in such a case the anti-aircraft guns would be turned effectively on the aeroplanes.

Some remarkable records have been made by aviators and observers engaged in spotting artillery fire. The French Lieutenant Perrin de Brichambaut has been engaged in that work since the beginning of the war and in less than two years flew over the enemy lines 1100 hours.

Spotting artillery fire at night is more difficult in a way, but less dangerous—provided the aviator has had experience in night flying. The targets are detected by the lights—since the enemy cannot operate unless it has lights and even the smallest light can be seen from the air.

The methods and codes used in communicating from and to airplanes change continuously, as each side quickly learns the enemy's methods. An airplane may serve from one to four batteries. When the battery commander wishes to use the airplanes to locate a target he explains what he requires and, if possible the nature of the target and its general direction. The airplane then rises to the necessary height behind the battery in order to run less danger of injury by hostile fire. Meanwhile strips of white cloth are laid out on the ground near the battery so as to give the supposed direction of the target and other instructions. The observer is equipped with a special map, usually scale 1/20,000. The large rectangles on the map are lettered a, b, c, etc., and are divided into squares of 1000 yards side, which are numbered 1, 2, 3, etc. Each of these squares is subdivided into four minor squares of 500 yards side. These minor squares are, in turn, considered as lettered a, b, c, d.

There are shown in different ways, first, second and third-class roads, whether fenced or unfenced; double and single track railways, footpaths, cartracks, buildings, elevations (which are given in meters), etc.

There are four methods of transmitting information from airplanes, as follows: (1) Wireless, (2) Lamps, (3) Very Lights, (4) Smoke Puffs. The wireless message is always stronger when the aeroplane flies towards the battery.

The observer having located the position of the target and conveyed the information to the artillery commander, receives from him the signal "Observe for line." The airplane now moves, keeping on that side of the battery furthest from the sun so that the signals can be easily seen. Range having been obtained the signal "Observe for fuze" is sent, etc. When the signal "Land" is sent the airplane comes down at a place previously selected and not necessary at the spot whence the signals are sent.

Kite balloons are used extensively for spotting artillery fire. The balloons are usually located a few miles behind the lines and are sent up to a height of about 2000 feet. For close range observing the kite balloon observer can do more accurate work than the airplane observer. This is also true about observing at night. The holding cable of the balloon, which is used for hauling the balloon up and down, is especially constructed in such a way that it has a small insulated wire in the center, which is used for the return circuit.

Any place where it is desired to have messages dropped will be marked by a cross on the ground made of two strips of white cloth about 15 feet by 3 feet. White strips on the ground, 6 ft. by 1 ft. can be seen from a height of 3000 ft., and a pre-arranged code of signals can be made by this means. It is possible to signal between airships with a signal flag by semaphore or Morse code provided the aircraft are broadside on to each other, and not over 1000 yds. apart.

—Fire Control—Instruments and Equipment

[A "Firing Board," for Indirect Aiming, for Mobile Artillery. By Lieut. Allan Cyrus, Royal Swedish Artillery. *Svensk Kustartilleritidskrift,* Part 4, '16. 1200 words. 2 figs.]

A description of the construction of a "Firing Board" by means of which the guns of a battery can be laid in *indirect* aiming both quickly and accurately, and also how to use this board.

(Without the figures, one of which shows the board with all its movable parts, no clear description of the board can be given.)

—Heavy

[Artillery of Heavy Caliber. *Revista Militar,* Sept, '16. 220 words. 2 illustrations.]

(A short description of present day methods of transporting and operating siege guns of heavy caliber.)

United States

[Applying the Lessons of War. *Army & Navy Jour.,* Jan 13, '17. 1100 words.]

The Chief of Ordnance, U. S. Army, has informed the House Military Committee that his Department has under construction for experimental purposes pilot models of both 12-inch and 16-inch howitzers for use as mobile artillery. He has information that guns of about 9-inch caliber are those used with most effect on European battlefields, the effect of larger guns being considered as negligible.

A joint committee composed of officers from the aeronautical branches of the army and navy, the General Staff of the army and the General Board of the navy, have completed a thoro study of the present status of rigid airships, and have reported that the Zeppelin is the type best fitted for the needs of this country. A joint board of aeronautical experts from the army and navy will begin at once the construction of a rigid airship along the general lines of the Zeppelin.

[French Gun Factories to Supply American Armies . . . with Heavy Field Artillery . . . *Official Bulletin,* July 21, '17. 1000 words.]

The War Department announces that there is intense activity in regard to the equipment of the increased forces of the U. S. Some classes of supplies had been accumulated in considerable quantity. Manu-

facturing establishments of large capacity had been created for the manufacture of field artillery ammunition due to the demands of the war, and there will be no difficulty in the supply of ammunition. But there is a shortage of field artillery, and this class of material cannot be made on short notice. The manufacture by forging, machining, and assembling takes time. Not only was there a shortage in the pre-war program, but the present day demand is for largely increased numbers of guns and quantities of ammunition, and the War Department found itself worse off for these supplies than in any other respect. It would have been difficult to increase production greatly without disarranging other necessary manufactures.

A solution has been found that will go far toward meeting the situation. The gun factories of France have attained a surplus of capacity and can manufacture for us if supplied with the necessary forgings. The Ordnance Department has placed orders for an initial supply of 75 mm. guns and 155 mm. howitzers with the French Government. These guns can be furnished promptly.

Our own guns will be used for instruction and target practice at home. When worn and in need of relining, they will be re-calibered to the French ammunition, and all future manufactures will be of French (75 mm.) caliber. Thus interchangeability of ammunition for our forces and the Allies will be secured.

—Heavy—Use of in European War

[Heavy Artillery in the War. By C. F. Heyman. Reprint from *Correspondencia Alemana. Memorial de Caballería,* Dec, '16. 1300 words.]

The fundamental difference between the howitzer or mortar and the long range gun is that the former is used for indirect fire and has a low initial velocity, while the latter is used for direct fire and has a high initial velocity.

The development of the mortar has culminated in the wonderful 42 cm. piece, better known by the nickname of *Fat Bertha.* The details of construction of this terrible weapon are rigorously guarded from the public so that only a general idea can be formed of what it is like and how it functions. Its length is about 5.25 meters. Its mission, as with all mortars, is to destroy concrete works, armored turrets, subterranean platforms, cement coverings, blindages, etc. The enemy can testify as to the efficiency of its fire. In the army, the field howitzer of 15 cm. pertains to the heavy artillery, but marine batteries up to 15 cm. are considered as of moderate weight. On the sea the calibers of heavy artillery begin at 21 cm. The heavy marine artillery is composed of rapid fire pieces, of which the 30.5 cm. is capable of firing one shot per minute. Our *long max,* used against Dunkirk for many months to the surprise and terror of the French, was of this class.

The long range of modern artillery is obtained by great initial velocity, which in turn is obtained by length of gun (with reference to the construction of the gun itself). The French have a singularly long gun (18.3 m.), of 30.5 cm., model 1906.

Dunkirk was bombarded by us at a distance of 35 kilometers. Targets were struck with great precision.

The English 38.1 cm. piece requires 200 kilograms of powder to give an initial velocity of 760 meters for a projectile weighing 885 kilograms. The estimated time of flight of this projectile for a range of 35 kilometers is about one minute. At close ranges the 38 cm. projectiles penetrate armor plate of from 1.25 to 1.53 meters in thickness, depending upon the material of which the plate is constructed. It penetrates 40 cm. of armorplate at 8000 meters and 34 cm. at 10,000 meters.

In construction, the best efforts of the English cannot equal the work of the house of Krupp. As a consequence their heavy guns last but a short while in service (80 shots). The English also are very slow in making heavy artillery; they require nine months to make a 30 cm. cannon. For these and other reasons they can never acquire superiority in heavy artillery over the Germans.

[The Allies' Answer to the Austro-Germans' Big Guns. *Scientific American,* Nov 4, '16. 250 words.]

The Allies have provided themselves with big guns, and it is claimed they are superior in this respect on the western front. France and Great Britain have built their own guns; Italy had numerous 12-inch batteries when she entered the war; and Russia is now fairly well supplied from Japan's arsenals. On the western front, many of the big guns are mounted on special railroad cars.

Great Britain

[Heavy Howitzers on the British Front. *Scientific American,* Dec 9, '16. 600 words. Illustrated.]

Heavy artillery of the Allies has been an important factor in enabling them to gain the initiative on the western front. This heavy artillery comprises pieces from 4.7 to 16 inches in caliber. Some are long range pieces of low trajectory, but the most of the heavy artillery is of the howitzer type. Illustrations show a type howitzer on a fixed mount and one mounted on a railroad car. In the latter, the gun is on a turntable in the center of the car, so designed that this turntable can rest entirely on supports on the ground, thus relieving the car of the heavy stresses of firing. The fixed mount howitzer has a swinging loading tray, and the gun is loaded in a horizontal position. There are four recoil cylinders, two above and two below the gun. Counter recoil is accomplished by springs.

—Instruction and Training

[Miniature Ranges for Outdoor Instruction. By Capt. E. H. Lovell, R.G.A. *Jour. Royal Artillery,* Apr, '16. 1500 words. Illus.]

A description is given of a range constructed for the Calcutta Port Volunteers, armed with 12-pdr. B. L. guns. However the range is considered suitable for any gun mounted on a travelling carriage.

A plot of ground was secured, 25 by 50 yards, in the fort against the wall of the men's five's court. This wall, reinforced by a subsidiary wall of kerosene oil tins filled with earth, was utilized as a bullet stop. A ramp of earth, 18 yards long by 12 yards broad,

FIELD ARTILLERY—Continued

was built with a slope of one on four, leaving about six feet clear from the wall to have room for tables for running targets, etc. Fifteen yards of the ramp were used as an artillery range and the remaining three yards as a rifle range. Distances of 20, 30, 40, and 50 yards were marked by pickets. A wooden table was placed behind the rifle range fitted to take disappearing targets and to be operated from a shelter at one corner of the range.

A 22-caliber rifle was fitted to each gun by adjustable wooden brackets which were finally tightened only after the rifle had been adjusted for line and range by calibration shots. It was found that, at a distance of 35 yards with a range setting of 2400 yards, the bullet just pitched at the bottom of the range, and owing to the slope of the ramp another 1000 yards was obtained. Longer ranges on the sight were obtained by moving the gun back.

Shrapnel ranging with this device was impossible but excellent results were obtained with percussion ranging.

The ground was arranged according to the problem assumed, and miniature buildings, trenches, and bodies of troops were stuck in the earth at suitable points. The range proved particularly useful in the instruction of gun layers.

[The Training of Senior N. C. O.'s at the Front. By Major P. R. Sargeaunt, R.G.A. *Jour. Royal Artillery*, Aug, '17. 2000 words.]

At the present time the majority of batteries in France are well supplied so that there can be at least one officer at the guns and one at the observing point. In order to supply any deficiency which might occur in the future a plan has been worked out for training the non-commissioned officers so that they can be commissioned when necessary, or, at least, fight their batteries temporarily in the absence of officers.

This plan leaves the instruction almost entirely to the battery commander and suggests that the work be carried on at odd times or when a battery is located in a quiet sector.

The subjects with which it is considered necessary to familiarize the non-commissioned officers are as follows:

(1). Director work and laying out Lines of Fire.
(2). Ranging.
(3). Map Reading.

The non-commissioned officers should be instructed on these subjects and should then be allowed to actually practice the different methods used.

Spain

[Pedagogical Orientation of the Complementary Courses of the Fourth Section of the Central School of Fire. By X. *Memorial de Caballería*, Feb, '17. 2600 words.]

The course at the school may be divided into three general groups: Instruction in firing and telemetry; effects of fire; armament, munitions and explosives. Three of the six working days of the week are devoted to practical exercises in the field. The other three days are devoted to technical conferences and individual research. At first it is very difficult for student-officers to accustom themselves to the novel idea that there are no text-books to be memorized. The aim of the school is to implant in its students the fecund ideas of scientific liberty, to broaden them and to develop their faculties of observation and discernment.

—Matériel—Guns

[French and German Light Field Artillery. *Journal of the Franklin Institute*, Mar, '17. From *Le Génie Civil*, vol. lxv, No. 21.]

The French 75 millimeter rapid fire field gun is not in its essential features a very recent production. It dates from 1897 when it was adopted to replace a slow firing arm of 90-millimeter caliber of a well-known type. It is better adapted to modern requirements and has a maximum rate of fire of 20 shots per minute. This rate of fire is attained, not by any one revolutionary feature of design but by the refinement of methods of operation now common in various forms to all light artillery. Prominent among these are the use of fixed ammunition, a long-recoil mount, and a quick-acting breech mechanism.

The caliber of 75 millimeters was adopted with the object of reducing weight as far as practicable. Its length of 33 calibers is somewhat greater than is generally employed in a field gun. The barrel is, as usual, a steel forging of suitable quality reinforced with a jacket. Departing from the common practice of hot shrinking, the jacket is forced in place cold, a method of assembling which avoids the molecular changes consequent upon hot shrinkage. The breech block, altho screwed in place, is not of the interrupted screw system now extensively employed in guns of all calibers. In its elemental features the breech is closed by a threaded cylinder, whose axis is parallel to the axis of the bore, somewhat greater in diameter than twice the bore. The breech housing into which this is fitted is eccentric with the bore, so that an orifice in the block at the same eccentricity with the axis of the block is diametrically opposite the bore when the block is screwed home. In that position the bore is covered by the base of the block. A rotation of 180 degrees brings the opening in the block in line with the bore and the breech is open for loading.

Perhaps the most serious obstacle to securing rapid fire in the former type of field gun lay in the necessity of relaying the gun after every shot. In modern field guns the carriage is anchored to the ground as firmly as possible and does not move. A pair of sliding ways controlled in position by the elevating and training gear but otherwise rigidly attached to the carriage is provided. The recoil takes place by the backward movement of the gun along these ways. This backward motion is restrained, partly by a spring, but mainly by a hydraulic buffer which consumes most of the recoil energy, while that part stored in the spring serves to push the gun forward into firing position. These retraction springs, usually helical springs of steel, have proved a troublesome feature, and the greatest care in their manufacture has been essential for their successful performance. In the "seventy-fives" steel springs are replaced by compressed air.

As the gun recoils the buffer fluid forces a free piston into an air-filled closed cylinder. The air so compressed pushes the gun into firing position, by its reversed action upon the piston after the recoil energy is consumed, and constitutes an ideal spring if leakage trouble can be overcome. The successful use of this device is one of the unique features of the gun. The recoil travel is 1.20 meters. Bearing in mind that in operation the barrel of the gun moves back and forth in a stationary slide, the sighting mechanism, which is attached to this member, is undisturbed.

The German field gun is of a model originally issued in 1896 and modified in 1906. In its modernized form it has an equipment practically similar to the French field piece, the difference being of design and dimensions. The barrel is 77 millimeters caliber and its length is 27.3 calibers. The breech is closed by a block, arranged to slide transversely to the bore, a method which is typical of the system in general use in German artillery. The recoil is absorbed by a hydraulic buffer in which a helical spring is used to return the gun to firing position.

A tabular comparison of the leading dimensions and performance of the two guns shows clearly to what extent they differ.

	FRENCH 75	GERMAN 77
Length of piece, meters	2.475	2.400
Maximum range, kilom	6.500	5.300
Weight of projectile, kilogr	7.200	6.850
Weight of charge, kilogr	0.700	0.570
Weight per unit of section, kilogr	163.	147.
Initial velocity, meters	529.	465.
Velocity at 1000 meters, meters	413.	369.
Velocity at 2000 meters, meters	334.	310.
Velocity at 3000 meters, meters	290.	275.
Muzzle energy, kg./m	103.5	75.
Energy at 2000 meters, kg./m	40.9	33.6
Number and weight of shrapnel balls,	300 @ 12 gr.	200 @ 10 gr.
Danger zone for height of 1 meter:		
At 1000 meters, meters	41.	31.
At 2000 meters, meters	15.	12.
At 3000 meters, meters	7.6	6.5
Thickness of shield, millimeters	3.	5.
Weight of piece in action, kilogr	1100.	950.
Weight of piece limber equipped, kilogr.	1950.	1850.

—Matériel—Trench Mortars

See also

GRENADES—USE OF IN EUROPEAN WAR (Article: "Types of Metal Grenades and Grenade Guns")

[The Forerunner of the Minenwerfer. Anonymous. *Schweiz, Zeit. f. Art. u. Genie,* Apr, '16. 1000 words.]

(A sketch of the ancient and modern appliances being used to project torpedoes, bomb and grenades in modern trench warfare.)

[Minenwerfer. Anonymous. *Schweiz. Zeit. f. Art u. Genie,* May, '16. 1200 words.]

The first minenwerfer had already been constructed by German engineers before the beginning of the war. It was designed principally for fortress warfare and must be considered as an adjunct to the heavy mortars. The minenwerfer was to take the place of artillery fire when the infantry had advanced so far as to make this fire dangerous to them. Another purpose was the destruction of targets not easily reached by ordinary artillery fire such as wire entanglements, abatis, traverses and bomb proofs. After the battle of the Marne they found general use on both sides in the resulting trench warfare.

[Trench Guns. *Voenny Sbornik,* June, '16. Reprint from London *Sphere.* 1000 words.]

Many forms of trench guns have come into common use. Among these are the French *crapouillot,* which is an old style mortar adapted to modern uses. In this mortar a charge of high explosives is enclosed in a cylindrical case of steel, with a fuse actuated by a bolt passing thru the head of the projectile, and fired by the impact of the shell.

Another form of trench gun is the "gunbarrel," in which the projectile is attached to the end of a staff, the latter only being inserted in the gunbarrel. The shell is a cylinder with semi-spherical ends, and with metal wings for steadying the shell in its flight. The angle of fire is set by a wing nut on the side of the carriage holding the "gunbarrel."

The German trench gun is an ordinary mortar, about 9.6 inch caliber, 3 feet long, and firing shell of the usual form. The gun is set at the proper angle of fire by means of a graduated arc on the side of the carriage, and geared into a threaded handwheel.

[A Noiseless Trench Gun. *Scientific American,* Mar 17, '17. 330 words. Illustrated.]

The Germans, anticipating modern trench warfare, had provided a fair number of trench mortars. The French and British, totally unprepared in this respect, had to improvise trench artillery from spent cartridge cases, tin cans, old boxes, etc. The Entente troops are now equipped with trench artillery, comparable to, if not surpassing, that of the Germans. The French now have a pneumatic bomb thrower, consisting of a breech loading barrel to which is attached a compressed air tank charged by means of a simple hand pump. The mortar is discharged by admitting the compressed air from the tank to the breech. As the operation of this mortar is silent, the enemy is unwarned and caught unawares by the trench bomb.

[Trench Mortars. *Scientific American,* Nov 3, '17. 500 words.]

The idea of using compressed air or gas to propel the aerial torpedo is not new. In several of his campaigns Napoleon encountered Austrian troops equipped with pneumatic rifles, and he is said to have considered adopting this type of weapon. At various times during the 19th century the idea of pneumatic cannon was suggested, and full sized compressed air artillery was constructed and tested. But with the introduction of modern explosives the pneumatic cannon was laid aside as an impractical weapon. It has been revived in this war in the form of a highly perfected trench mortar.

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In the present pneumatic trench mortar the propelling charge is supplied either from a tank of compressed air or gas, such as carbon dioxide, or from a tank which is charged by means of a hand-pump. In either case the tank can be used for a number of rounds before it is recharged, since only a puff is necessary to eject the projectile. In the case of the hand-pump type, 200 or 250 strokes of the pump handle are sufficient to produce a pressure of eight to ten atmospheres in the reservoir, which, in turn, is sufficient for a number of rounds. The apparatus which releases the puff of air is operated by means of a trigger or lanyard, and immediately following the release of the propelling charge an automatic valve shuts off the further escape of air or gas from the tank. Indeed, it is the mechanism which only allows a sudden puff of air or gas to be injected into the chamber of the cannon, behind the projectile, which presented the greatest problem in the development of this type of artillery.

It is reported that, aside from being silent and inexpensive of operation, the pneumatic mortar lends itself to ready manipulation. It can be handled at a fairly high rate of speed. Most important of all, however, is the fact that the aim of the pneumatic trench mortar is exceedingly accurate, provided the reservoir is not discharged below a certain point. Obviously, it is the short range over which the trench mortar must be operated, namely, 750 to 1000 feet, which has made this form of pneumatic artillery a military success.

—Motor Transport

[Artillery Problems—Mobility. *Army & Navy Gazette and Broad Arrow,* May 5, '17. 1000 words.]

The present war has produced little that is new in the problems of artillery. The "barrage" and registration of ranges are cases in point. At the battle of St. Privat in 1870 the French attack from the direction of Amanvillers was checked by the Prussian artillery which had previously registered the ranges to certain points in the line of advance. There is, consequently, nothing new in the barrage except the increase in its intensity. Then, again, the great development in the employment of heavy artillery had been foreseen. For instance, as matériel has developed, it is natural that the weight of the weapons used should have increased. Since the adoption of railways and motor traction for moving heavy ordnance, the problem of mobility is solved, and it is clear that no limit can be put on the variety or caliber of the pieces that can be employed.

In spite of these complications, field artillery will still exist as an arm in itself. Probably two branches will be required, one equipped with a heavy gun and the other with a medium gun. The difficulty arises as to where the dividing line should be drawn, and how far it is possible to combine power with mobility. In each case it may be said that the heaviest equipment consistent with mobility should be used. Weight could be reduced by carrying no ammunition in the limber. Also, mobility can be increased by dividing up the load. In the case of one foreign heavy equipment, the howitzer is carried on a travelling carriage as distinct from the firing carriage.

It is likely that horses will eventually be superseded by motor tractors capable of crossing broken ground rapidly enough to effect a surprise or follow up a retreat.

[Fully Motorized Field Battery Developed by U. S. Army. *Official Bulletin,* May 28, '17. 750 words.]

The U. S. Army has developed what is believed to be the first completely motorized field battery of medium caliber guns in the world. It is expected that the motorization of most medium caliber guns which have previously been horse-drawn will come in the near future. The large howitzer types are sure to be motorized.

The new creeping or self track laying type of tractor of small or medium size developed by the American Army is built without the steering arrangement in front, and while possessing relatively as much power as the type now used in Europe is at the same time capable of turning within its own length by simply reversing or stopping one of the creeper drivers while the other side continues to move ahead. The development in this type in tractors powerful enough to haul the heaviest guns will make them entirely available for making the sharp turns and corners and fitting into the inconvenient spaces for which horses have so far had to be used at the very front. The experiments have proceeded far enough to justify plans for the successive motorization of all American artillery units except the smallest calibers required to move at very high speed over bad ground.

The new developments in ordnance traction make up another phase of the valuable experience the American Army gained on the Mexican border, as they are a direct outgrowth of experiments made at that time in hauling field guns with American tractors.

Tractors More Efficient

The reasons making it highly desirable to substitute the tractor for the horse in all ordnance traction are both scientific and humane. From a scientific and military standpoint the tractor is much more efficient than the horse. It lasts longer, is capable of performing more work in a day, and costs less for repairs and fuel than the expense of upkeep of the horse. A tractor can, if necessary, be used 24 hours in a day, while the horse has to stop for rest, sleep, and feeding, and can seldom be worked more than 10 or 12 hours per day at the best. Repairs on tractors even at the front are usually comparatively brief tasks, unless the machine is completely destroyed by shell fire, while horses are continually liable not only to wounds but to disease and injury from exposure and lack of proper care under field conditions. The care of machines, as compared with that which horses must have, is negligible, while the bulky food supply for horses is always a difficult problem.

The humane reasons are equally obvious. The life of the artillery horse at the front is not only brief but

often one full of agony. It is seldom possible to give the animals anything like proper shelter and care, and their usual lot is quick death by disease if they are not killed off by shell fire.

—Range Finding

[Ranging from an Observation Post to a Flank. By Anon. *Jour. Royal Artillery*, Sept, '16. 2200 words. 3 figs.]

Ranging a battery on a narrow target from an O. P. to a flank has from the beginning of the war been regarded by many battery commanders as one of the most difficult operations they are called upon to carry out.

There is no doubt but that on many occasions far more ammunition is expended than necessary on this type of shooting, and it is to be feared that sometimes it is expended without result, owing to the battery commander's having no system.

Many schemes have been put forward, and possibly the best solution has not been found yet, as most battery commanders adopt any expedient rather than range from a flank.

The solution, when the battery commander is close up and has a good view of the ground around the target, or has a broad easy target on which to range, is excluded as he should be able to range on the line B-T without difficulty.

In the simple case when the battery commander is on the line B-T, he first corrects his line by altering the deflection, and then he ranges by bracketing the target, observing whether the burst obscures the target, or the target is silhouetted against the burst. When he has his M. P. I. on the target, a certain proportion of rounds will hit the target, depending upon its size and the length of the 50 per cent zone, and the remainder of the rounds will fall over or short.

If the battery commander is to a flank, he proceeds on the same principles, but he must range on the line O-T instead of B-T. The observer must first get a round on his line O-T, and then proceed to range up and down that line. But when ranging from flank the battery commander must bear in mind the 50 per cent zone, and, when his shots do not appear to respond to corrections, he should not drop the whole system as erroneous and begin to make wild corrections. Even after corrections have been made to bring the bursts on the line O-T, only a certain percentage will fall on that line. If a shot does not fall where expected, repeat with the same setting, even two or three times if necessary, until some consistent results are obtained.

To get on the line of observation, either elevation or deflection may be altered. Except with apex angles of less than 20 degrees it is better to alter the elevation if the battery commander is sure his line is correct. But if he feels that the error may be either in line or range, with angles under 45 degrees use deflection, over 45 degrees use elevation.

In making corrections the observed error must be corrected by a simple factor which can be taken out of the range tables.

After getting on the line O-T, range up and down that line until a bracket is obtained. To keep on the line O-T, both elevation and deflection must be altered by application of a combined factor, also taken from the range tables. For example: the battery commander is bracketing with elevation, the combined factor is one-half; now, if the battery commander goes up 80 minutes in elevation, he also must give 40 minutes more left deflection. This combined factor must always be used to determine the change in deflection at each change in elevation. Similarly for bracketing with deflection; the combined factor then is the reciprocal of the other.

[Firing by Map. By A. N. *The Military Historian and Economist*, Oct, '16. 2000 words.]

The war in Europe has almost developed into an artillery war. Trenches, entanglements and shelters are destroyed by bombardment, and then the infantry, supported by machine guns and protected by a curtain of fire, moves forward for the final attack. The artillery fire must be carefully organized and executed in order that no part of the hostile line may escape its share of the bombardment. To accomplish this task, careful and accurate methods are essential; and since accuracy of artillery fire depends upon observation, improvement has been directed along that line. The observers are pushed up to the infantry trenches and their work supplemented by airplanes and captive balloons.

An elaborate system of communication and an accurate large-scale map (6 inches=1 mile) of the terrain are necessary in order that the batteries may make proper use of their observers. This map is divided into lettered or numbered squares and shows the topography, and also the line of friendly entanglements within which it is unsafe to fire. Battery positions, etc., are not shown, as one of the maps might fall into the hands of the enemy.

The method of observing and transmitting information and relocating on the map is as follows:

The observer, who is provided with a range-finder and an angle-measuring instrument, observes movements of infantry or flashes of hostile guns in his sector. He determines the range and direction which fix for him a certain point in a certain square which must be brought under fire. The number or letter of this square is sent to the battery by telephone. The officers at the batteries quickly locate on their map the given square, determine by protractor or map-scale the distance and direction from the guns, and commence firing.

[Resetting Range Drums of 18-pr. Guns to Account for Loss in Muzzle Velocity. By Lieut. F. C. Higgins, C.F.A. *Jour. Royal Artillery*, Sept, '17. 2000 words.]

Battery Commanders often reset the range drums of 18-pr. guns in order to automatically account for errors in shooting due to loss of M.V. This eliminates

FIELD ARTILLERY—Continued

the trouble of having to apply a set of gun corrections at the different ranges. At the range for which the correction is made this is very satisfactory but at all other ranges this introduces an appreciable error. It will be found to be not only a question of errors in range but also of the correct fuze length, for the latter will not be the same under the conditions imposed by this practice as would normally obtain. This is quite as important as an error in range.

Consider a battery in which the guns have been carefully calibrated and found to be shooting short at 3000 yards, by 25, 50, 75, 100, 125 and 150 yards, respectively for the six guns. If now the range drums are altered to offset the above errors in order to make the guns shoot map range at 3000 yards, the increase in angle of elevation thus effected would be 3.5, 7, 10.5, 14, 17.5 and 21 minutes.

At this particular range (3000 yards) there will be no error at all in the range, as the angle of elevation has been altered exactly to counteract the loss in M.V. in the case of each gun. The error incurred in the fuze length will depend solely upon the difference in time of flight brought about by the loss of M.V. of the gun. This loss causes the shell to fall short of the actual map range appearing in the range dial (for which the fuze is determined) and hence produces a shorter time of flight. It is very unlikely, however, that this decrease in time of flight due to loss in M.V. is as great as that caused by a difference in elevation which would make the shell fall short of the target by the same amount. The decrease in time of flight due to lessened M.V. is generally considered as about one-half of that due to a difference of elevation which would cause the same extent of error. But the fact that the range drums have been altered, thus changing the angle of elevation, imposes certain complications, the effect of which must be taken into account.

Take for example the gun which previously shot 75 yards short. The time of flight for which the fuze will be determined will be for a range of 3000 yards which is the range appearing on the range dial. The increase in angle of elevation equivalent to an increase in range of 75 yards will increase the time of flight .22 seconds. But the loss in M.V. causing the shell to fall 75 yards short of the range equivalent to the total angle of elevation on the gun will decrease the time of flight by .11 seconds. The total increase is .11 seconds, which means that the fuze length used will be about .1 too short for this particular gun.

Similarly, in the case of the last three guns, the errors will be respectively .15, .2 and .25 on the fuze. Hence, four guns out of six will be firing time shrapnel with an average mean point of burst almost 20 minutes above the line of sight.

At 2500 yards a similar condition will obtain, only the errors in fuze setting will be proportionately greater. On the other hand the errors in range will average less than 25 yards and are therefore not very important.

There are two factors to be considered, the resultant effect of which must be determined—(1) the M.V. of each gun, which produces greater errors as the range increases, and (2) the alteration made in the angle of elevation when resetting the range dials. The second factor produces less effect on the range as the latter increases and hence steadily loses its initial corrective value. It will be found that whereas on the one hand the resultant errors in range will increase as the range increases, on the other hand the errors in proper fuze length will be much greater at the shorter, and more important ranges.

At 4000 yards the M.V.'s of the respective guns would cause them to shoot short by 30, 58, 87, 116, 145 and 175 yards. As corrected they would shoot short by 9, 16, 24, 32, 40 and 49 yards. Hence, the first two guns only can be said to have kept even a fair degree of accuracy. For the first two guns the error in fuze length is not appreciable but for the last two guns the length of fuze will be more than .1 too short.

At 5000 yards, the guns as corrected would shoot short by 15, 28, 40, 53, 66 and 79 yards. In this case there is only one gun, the first, which has not incurred quite a serious error. The errors in fuze length at this range are, however, practically negligible.

If these figures which we have found to obtain at ranges from 2500 yards to 5000 yards be compared with a similar set of figures worked out for the same guns at the same ranges, but in which a set of gun corrections and corrector changes for the various guns are made by the Nos. 1, we would find that in the latter case no range errors would be greater than 12½ yards, and there would be no fuze error. Even if only one mean correction to the range and corrector be made for all ranges, the errors will never exceed 25 yards, with no error in fuze length.

[Note on Finding Lowest Elevation to Clear Crest By Means of No. 7 Dial Sight. By 2nd Lieut. J. N. Kennedy, R.G.A. *Jour. Royal Artillery,* Jan, '17. 600 words. 1 fig.]

The object of this note is to point out the inaccuracy and possible danger of estimating the minimum elevation necessary to clear an intervening crest by the method prescribed in the Drill Pamphlets in cases where the crest is close to the battery position.

In the case in point, applying the methods of the drill books indicated that with a range setting of 2000 yards the trajectory would clear a crest distant 50 yards from the battery position. However on looking thru the bore, the gun was observed to be laid on the hill side considerably below the skyline. The explanation is found in the difference of level of the sight and the axis of the bore.

—Range Finding—Ballistics

[Temperature and Other Corrections. By Lieut.-Col. H. W. Hill, R.F.A. *Jour. Royal Artillery,* Dec, '16. 2000 words.]

An accurate working knowledge of temperature and other corrections that should be applied to map (or previously registered) ranges is essential to all gunner officers. If the principles underlying these corrections are not fully grasped, two things are likely to occur:

First, an unnecessary expenditure of ammunition in determining the error of the day and in checking registration.'

Second, ineffective fire at critical periods.

In the latter case the fire even may cause casualties to our own troops.

Corrections are required for the following reasons:

1. The range in yards on the map is seldom, if ever, the same as that found by the gun.

2. The range in yards required to hit a given target may vary considerably from day to day, or even from hour to hour.

The changing of the muzzle velocity and of the shape of the projectile all affect the range of the gun as determined under normal conditions. These conditions are:

Temperature of air, 60 degrees F.
Temperature of charge, 60 degrees F.
Wind, nil.
Barometer, 30 inches.

Variations in ballistic conditions may necessitate considerable alterations in a previously registered range, and the mere statement of that range is of but small value without some statement as to atmospheric conditions.

Changes in temperature affect not only the density of the air and its resistance to the flight of the projectile, but also the temperature of the charge, which changes the muzzle velocity.

Changes in barometric pressure affect the density of the air and the flight of the projectile as a result.

Accurate corrections due to wind are most difficult to make since it is seldom that the force of the wind with regard to the path of the projectile can be determined definitely. As a result ranges registered in windy weather might be marked as doubtful or thrown aside.

As shooting frequently must be carried out from the map, the above considerations show the necessity for close study of temperature and other corrections, and the necessity for proper application of them.

—Range Finding—Instruments and Equipment

[Displacement Tables for Eccentrically Sited Battery Positions. By Maj. W. H. Fry, M.C., R.G.A. *Jour. Royal Artillery*, Sept, '17. 350 words. Diagrams and tables.]

With the huge concentration of batteries now entailed, the placing of guns in eccentrically shaped positions becomes a necessity, and the resulting corrections in line and range as measured from the standard gun, must be considered.

The following method permits of compiling tables from which the corrections can be quickly and accurately obtained. The distance from the standard gun to each of the other guns is measured in yards, D_2, D_3, D_4 yards respectively; the dial sight of the standard gun is turned on to each of the other guns in turn, from the zero-line reading, giving $A°_2$, $A°_3$, $A°_4$, respectively.

Then, when firing on the zero point, displacement for line is that equivalent to d_2, d_3, d_4 in turn (where $dn = Dn \sin An$), its equivalent in minutes being

$$\frac{3438\,dn}{Rn}.$$

This formula is easily solved by slide rule, by placing range on B scale under 3438 on A scale, and reading in on the A scale over d yards on the B scale. This process is carried out for switches of every 10 degrees right and left of zero lines, thru the arc of fire, at all ranges, and the results tabluated.

The range correction is given Dn $\cos \overline{An—S}$ or Dn $\sin \overline{90°—An—S}$ which is read from the slide rule.

[Slide Rule for Finding Range to Clear Crest. By 2nd Lieut. A. Jennings, R.F.A. *Jour. Royal Artillery*, Jan, '17. 250 words. 1 fig.]

This device is the ordinary type of slide rule. It has four scales, two on the fixed and two on the sliding bar. The arguments are, angle to crest, angle of site, both in degrees, and range to crest in yards.

Method of Using

Put angle of site under angle to crest and read minimum range to clear crest under range to crest.

[Wind Dial Corrector. By 2nd Lieut. R. A. Aslett, R.G.A. *Jour. Royal Artillery*, Jan, '17. 750 words. Illus.]

(This article describes a type of wind dial corrector which was in use at the Somme. It does away with all calculations and references to tables, by giving immediately the required corrections in minutes of elevation and deflection.

For description and method of operation, reference should be had to the complete article.)

[Wind Dial for 4.5 Howitzers. By 2d Lt. W. L. Dennis, R.F.A. *Jour. Royal Artillery*, Sept, '17. 350 words. 1 chart.]

(The Wind Dial is used for making wind corrections both for range and deflection. Its construction is simple and no reference to tables is required. By its use the determination of the corrections for wind is made rapidly and without trouble.

The original article should be consulted for description and method of use, as it does not admit of digesting in a manner to be of value without the chart.)

—Tactics

[Field Artillery: The Tactics and Technique of Field Artillery. By Eduardo Pellen, Lieut.-Col., F. A. *Revista da Artilharia*, Aug, '16. 400 words. To be continued.]

(An elementary study of field artillery.)

[The Tactics and Technique of Field Artillery. By Eduardo Pellen, Lieut.-Col. of Field Artillery. Continued. *Revista da Artilharia*. Sept-Oct, '16. 6000 words. (To be continued.)]

(In this number the author describes the well known methods of putting field artillery into action, with the usual commands, and the duties of the personnel.)

FIELD ARTILLERY—Continued

[The Tactics and Technique of Field Artillery. By Eduardo Pellen, Lieut.-Col. F. A., continued. *Revista da Artilharia,* Nov, '16. 3000 words, 5 diagrams. To be continued.]

(In this number the author describes the selection of positions for the batteries, and gives a mathematical discussion of the preparation and conduct of fire.)

[The Tactics and Technique of Field Artillery. By Eduardo Pellen, Lieut.-Col., F. A. *Revista de Artiltaria,* Dec-Jan, '16-'17. Continued. 7000 words and one plate. To be continued.]

(In this number the author continues his mathematical discussion of range finding and exterior ballistics.)

[The Rôle of Artillery in the Attack of Field Fortifications. By Capt. Bari. *Memorial del Ejército de Chile,* June, '17. 2000 words.]

The nature of a fortified position may vary from a simple height protected by infantry fire trenches and light emplacements for field artillery to carefully prepared positions provided with a complete network of fire, cover, communicating and approach trenches, fully equipped with all accessories and with properly prepared artillery emplacements in which batteries may be hidden from view even of the enemy's aviators. The fundamental principles of the use of artillery are the same, however, in all cases. It is always necessary for the attacker to reconnoiter for the purpose of locating the hostile fire trenches, flanks and artillery positions, location of supports and reserves, etc.

It may be necessary at times for the heavy pieces of the attacker to open fire in order to force a reply from the enemy's artillery. In this way the enemy may be made to disclose his positions and strength.

It is important that the following points with reference to the adversary be determined in advance by the artillery:

(1) The situation and extent of the enemy's position.

(2) Condition of flanks and arrangements for supporting or strengthening same.

(3) Location of opposing artillery.

(4) Class and resistance of fortifications.

(5) Terrain to be crossed by attacking infantry.

(6) Obstacles, locations, quality and strength.

(7) False positions, dummy trenches and guns, etc.

(8) Division of enemy's forces.

Once in possession of this information, the artillery proceeds, (1) to select its own positions. (This may have been designated by the supreme commander, or better still, the selection may have been left to the judgment of the artillery commanders.)

(2) To select good observation points.

(3) To arrange for protection and support of attacking infantry.

(4) To locate roads for deployment and for advancing.

(5) To determine points in the hostile positions in which conditions are specially favorable for the attack.

It must be remembered that one of the most important objectives of the artillery is the hostile machine guns. Time fire is used generally; only in special circumstances is percussion fire used. Should the attacking forces possess both field and heavy artillery, appropriate objectives must be designated for each. Batteries never change positions simultaneously. Observers are always sent forward with the infantry to keep the artillery informed as to the progress of the former.

During the attack, the artillery must give efficient protection to the infantry, even to the extent of sacrificing guns, should this be necessary.

—Tactics—Co-operation with Other Arms

See also

INFANTRY—ATTACK (Article: The Infantry Advance as Related to Artillery Fire.)

[A Quick-Firing Cannon Which Advances With the Skirmishers. *Scientific American,* Aug 4, '17. 300 words. Illustrated.]

The French have recently introduced a quickfiring 37 m.m. gun firing up to 35 shots per minute, with a range well over a mile. It can be taken apart and carried by six or eight men. It has quick-acting breech mechanicism, accurate sights, and automatic recoil. It is used in advanced positions or in the open against machine gun positions. (The illustration shows a forked mounting with flat trail with the axis of the bore about 18 inches from the ground.—ED.)

—Tactics—Selection and Occupation of Positions

[The Grouping of Artillery for Battle and for Position Warfare. By Col. William Bergman. *Journal of the Royal (Swedish) Academy of the Science of War.* Apr, '17. 4100 words.]

Before and during the war of 1870-1, it was held that the field artillery of an army should be collected during battle in as large groups as possible and on high points from which an unobstructed view of the enemy's lines could be obtained. It might be called the windmill background grouping. It began during the Napoleonic wars and, in a modified form, survived until nearly the end of the last century. Its object was to enclose the battle area in an iron frame of artillery fire.

About 1890 there was published in Paris a very notable work by Col. Langlois of the French artillery, entitled *"L'Artillerie de Campagne en liaison avec les autres armes,"* in which the author showed the fallacy of the existing system and advocated a radical change in it, a more intimate co-operation between the artillery and infantry. This as we know led to radical changes in the armament of the field artillery, the introduction of the rapid fire field guns with shields, and the placing of these guns in sheltered positions on the field of battle. Heavy artillery was also assigned to the field army, and at the outbreak of the world war the general form of grouping of the artillery of an army corps was

to place it in three special groups, one for each of the two light artillery regiments and one for the heavy field artillery. These groups were also subdivided into smaller groups according to the requirements of the terrain.

As the world war changed its character from mobile to position warfare, the grouping and use of the artillery were again materially changed owing to the new requirements made of it, the most striking being that both light and heavy artillery are often grouped together.

At present, therefore, we find two different systems of grouping the artillery; one used in mobile field warfare, where it is kept in separate groups for light and heavy artillery, each by itself; and the other in mixed groups, used in position warfare, in which a group may consist of all kinds of guns from light mountain artillery up to the heaviest calibers that can be transported.

As to the objects fired at, since the light field artillery fires shrapnel, it will naturally be employed to fire at living targets, as troops in position or on the march; while the heavy artillery, firing explosive shell, would be employed against inanimate targets, such as trenches, batteries, etc.

The heavy artillery can as a rule be kept in larger groups, in which the guns can act together, while the light artillery must early in the battle be divided up and directed against the various individual groups of the enemy.

As long as the battle is changing from position to position, either forward or backward, the respective chiefs of units, usually regimental or battalion commanders, locate and direct the fire of their units, under the general direction of their corps chiefs. But as soon as the movement stops and the battle develops into position warfare, the units are split up and other groups are formed, each consisting of such different guns as are needed for each position. In case of occupying a fortified defensive position, the artillery is of course from the beginning assigned according to the needs of each position.

The Austrian positions in the Tyrol and on the Isonzo had been visited by the writer, and he describes the principles on which their artillery was grouped and the fire controlled. Some of the older fortifications had been abandoned and left as dummy batteries, while the real batteries were in other positions now found more advantageous. Each artillery group, covering a certain front of the defense, was under its artillery chief. Several of these were grouped under an artillery commander who had charge of the defense of that area and corresponded to a corps commander. There were also artillery officers of higher rank who had charge of the conduct of the entire artillery operations.

In preparation for the defense of a position, it was required that the different battery commanders should have trial firing at the important objectives within range, and that a record of these firings be entered in a journal of fire for future use. All deflection angles to targets should be referred to a carefully selected fixed directing point which would not be likely to be disturbed under any circumstances. By means of these records the batteries could afterward, by night as well as by day, instantly open effective fire on any point within their fire area. Observers connected by telephone with the batteries were also placed well to the front, even as far forward as the front line of trenches. A detailed plan of fire is also made by the artillery commander for the employment of the different batteries acting together or separately, and he is also responsible to the corps commander that a sufficient number of guns of suitable calibers are so placed that an effective fire can be directed against any point of the front likely to be attacked. The necessary aerial observers should also be placed under the artillery commander.

At the writer's visit to the Austrian position east of Gorizia, he was told that the fire of all the artillery of the corps, about 200 pieces, could be directed against any selected point of the Italian offensive front on the other side of the Isonzo.

The situation at Bukowina is given as an illustration of the conditions under which the artillery of an army corps may be under the control of one man. Here all the artillery of the Austrians, about 45 batteries, was put under one commander, an artillery general, who, from his fire direction position, could personally direct the fire by means of a comprehensive system of telephone connections and a great number of observers located along the whole front in the advanced trenches. It was expressly stipulated that this condition of one man direction should exist only as long as this army occupied a fixed position, and that as soon as the action became mobile the different artillery units should return to their respective places and be under their regular commanders in the mobile organization.

From the foregoing it follows that, for mobile warfare, the light field artillery should be organized and trained to be used in smaller separate units, the heavier artillery as corps artillery and the heaviest as siege artillery, without any mixture of the different classes.

—Transport of

See also

Field Artillery—Motor Transport

—Use of In European War

[Artillery Fire in Close Range Fighting. *Schweiz. Zeit. f. Art. u. Genie,* Aug, '16. 2000 words.]

In the course of the Austrian offensive in Bukowina in February, 1915, the 36th Division reached Chryplin, south of Stanislau. On Feb 21, this town had been cleared of Russians by the 87th Croatian Infantry Regiment, and the light howitzer battalion, 36th Austrian F. A., was ordered to take quarters in the city. The Russians had destroyed all the bridges over the Bystrica excepting the single track railroad bridge between Chryplin and Stanislau. The difficulties and the congestion of traffic in attempting to cross a division on a single bridge are indescribable. Not until late at night did the artillery succeed in getting across. Everyone was then so tired that as soon as billeted all went to sleep excepting the outpost.

FIELD ARTILLERY—Continued

By means of spies, the Russians got information of our dispositions and early in the morning surprised and overpowered the outpost. We were awakened by the firing and immediately received orders to go into action near the railroad square. But even while the batteries were hitching up, hostile artillery fire began falling all around the railroad station. The 4th battery at once prepared for action, ready to fire down the streets of Stanislau; the 3d battery and the combat train were ordered to cross back over the bridge and take a position in the opposite bank at Chryplin. But the Russians had already advanced within 300 m. of the battery. The condition was indeed critical. The 4th battery, therefore, limbered up under fire and was ordered to follow the 3d battery. Progress was slow. The road to the railroad bridge was being systematically searched by hostile artillery and machine gun fire doing frightful damage among the animals and personnel of the sanitary train, when the batteries arrived at the bridge, only to find traffic blocked. While waiting for traffic to be cleared, all six horses of the leading gun were struck and mortally wounded. The traces had to be cut, the animals, dead and wounded, pushed aside, before any further advance could be made. The Russians, however, kept the bridge under fire so that it would have been suicide to cross. The two batteries therefore went into action to the flank along the approach to the bridge. One platoon of infantry was assigned as a support. The Russians had in the meantime approached the bridge to within 1000 meters, some advanced groups being even closer. In advancing thus along the bank the enemy offered us a beautiful target at very short range. The men showed a fiendish delight in opening on them with direct fire. The firing was so rapid and intense that the ammunition soon gave out and provision had to be made for its resupply. Our difficult position soon became known at Chryplin. An armored train arrived in the nick of time, and assisted in decisively repulsing the Russian attack. This train later took the wounded, also several guns and ammunition wagons back to Chryplin. The next day one gun and several ammunition wagons which had to be left behind in the main square of Stanislau were recovered. The division was saved from annihilation by the bold and energetic action of the howitzer battalion which, in plain view, took the advancing Russians under direct fire at short ranges and thus enabled the infantry to recover from this unfortunate surprise. The casualties in the artillery were very heavy.

[The Doomed Battery. *Schweiz. Zeit. f. Art. u. Genie*, Aug, '16. 2500 words.]

The 5th Battery, 39th Austrian F. A., was ordered forward early in the morning of Sept 7, 1914, from Megjasi to support the infantry outpost on the Drina and to cover a crossing which was to be made near Daljau. The position was located on a sandy bank of the river and commanded the Serbian banks, the Limanska Ada and a wide stretch at the mouths of the Drina.

The guns were unlimbered under cover about 500 meters in rear of the position, from which point they had to be run forward by hand in plain view of Serbian observers in the trees on the opposite bank. One man remained with each gun, the rest of the gun detachments pulling on long prolonges. After having advanced 200 meters in this manner the enemy suddenly opened with several volleys, making all further progress impossible. The furrows and fuze heads gave the direction and range of the battery as 2200 meters.

Finally, at 7 p. m., under cover of the darkness, the battery was brought up and emplaced. At 9 p. m., in the bright moonlight, a pontoon was being thrown across for the 79th Infantry Regiment. Everything went nicely until the first pontoon reached the opposite shore. A hellish fire then broke loose. To support and to cover the crossing the battery now opened fire. After about half an hour the crossing was completed, but not without enormous losses. Now the hostile artillery opened on the battery which at once suspended its fire.

In the early morning hours another attempt was made to cross the infantry, but this was defeated by the overpowering machine gun and rifle fire from the hostile trenches. While supporting this attempt, the battery again was subjected to a hostile bombardment, this time apparently from two batteries. Nevertheless, the Austrian battery fired effectively upon a Serbian heavy battery in march and a supply column. The hostile trenches were kept under a continuous fire.

By 2 o'clock on the afternoon of Sept 8, the ammunition supply was running low; only a few shrapnel were still on hand, shell were all gone. The men were worn out completely and many quietly went to sleep in their bomb proofs while under hostile fire. Seeing that he was now opposed by three batteries, the battery commander telephoned for authority to withdraw. The reply was that the battery was to hold the position at all costs, if necessary also to sacrifice itself. Altho some pioneers were promised to assist in strengthening the position, they never arrived. The available time was then used to strengthen the position. Only 30 men were left. A meal was sent forward to them, but they seemed to care for coffee only. At 9 o'clock the lieutenant in command of one platoon observed preparations among the Serbs for a counter attack. To nip these preparations in the bud he ordered fire to be opened. This turned out to be the death knell of the battery. The Serbs opened up with their heavy artillery, and in a short time all the guns of the Austrian battery were put out of action or completely covered with sand and debris. The B. C. and six men were killed; an officer and two men were mortally wounded; eight others were severely wounded. Late in the afternoon an attempt was made to recover the two guns which were still serviceable. The Serbians, however, always opened fire as soon as they observed any movement in the position. Not until nightfall was it possible to recover these guns and the rest of the ammunition, and at 3 a. m., Sept 9, the acting B. C. reported back to Megjasi with the two guns and what

remained of the personnel. As a result of this engagement 15 members of the battery received the medal of honor.

[A Visit to the English Front in France. By Captain Victoriano Casajús. *La Guerra y su Preparación*, Dec, '16. 26 aerial photographs obtained from British Headquarters and 31 others from the *Illustrated War News*. 20,000 words.]

The battle of the Somme, at one phase of which we were present, represents the greatest effort of the English after the reorganization of their army, and has been the hardest fought battle in that theatre. It therefore lends itself readily to a study of the present day methods of warfare on that front and of the complete change of principles of military technique which these methods seem to represent.

The impression which I brought from the battlefield is that the artillery piece, allied with chemistry, and the gasolene motor, mastering the air and solving the question of land transport, have changed the face of war. I shall begin, then, by considering what in my judgment has played the most important part in this change, the artillery, and shall later analyze the modifications which the other arms and services have experienced due to the two new factors which I have just mentioned.

Artillery.—The gun has exceeded the limit of what was expected of it, the Germans having started its improvement by augmenting its power.

Before the war there were two theories with respect to the calibers of artillery. The French believed that the field piece, with its rapidity of fire, would hold its own against heavy artillery, while the German theory was that in addition to the field piece there was a necessity for a considerable number of heavy rifles and howitzers, to combat the enemy artillery, to destroy whatever intrenchments the troops might improvise and to reach targets at great distances. The result was that in the first part of the war the German heavy batteries, with the aid of aeroplanes, destroyed entire groups of enemy light batteries without the latter's being able to inflict any damage in return.

It was also believed formerly that artillery of more than six-inch caliber was only adapted to use against permanent fortifications and could not be transported with moving armies nor supplied with the necessary ammunition. The truth of the matter was shown, however, when the Germans and Austrians, in the first part of the war, provided their armies with howitzers of 27, 30, 38 and 42 centimeters, and used them not only to demolish permanent fortifications, but also against stores and depots in the enemy's rear, towns where troops were billeted, barbed wire entanglements and other obstacles, etc.

The lesson was quickly learned and the English Army immediately set about equipping itself for a fight which up to that time had been very unequal. As a consequence, from the 100 pieces with which they disembarked on the continent (only 18 of these howitzers of 11 cm. and 4 heavy guns of 12.5 cm.), which represented the small proportion of 1.66 pieces per thousand rifles, against the 6.4 guns to the same number of men, they have increased and improved their artillery to that which they are now using so effectively on the Somme.

From what we have seen and have otherwise been able to find out, they have to-day at the front, in addition to the 8.4 cm. field piece, 5-inch rifles with an effective range of 9140 meters, 6-inch howitzers, which shoot a projectile weighing 55 kilos to a distance of 6400 meters, 9.2-inch howitzers with a projectile of 131 kilos and a range of 9000 meters, 11 and 12-inch howitzers, and naval guns of 15-inch caliber which fire one shot a minute and have a range of 11 kilometers and a projectile of 770 kilos.

Number.—We have no information as to the number of guns in use by the British, but since the principles which formerly limited the amount of artillery that could be used are no longer applicable, it may be said that the number is regulated entirely by the country's capacity for production. The principle that the amount of artillery must not be so great as to lengthen the columns too much does not apply because there are no columns on this front. The number of pieces is no longer limited to that which will occupy only the portion of the front available for use by artillery, because the guns are no longer placed on a line at regular intervals, but are echeloned in rear.

Mobility.—All of the heavy pieces, except the naval guns, can be transported from one part of the line to another. Calibers less than 9 inches are mounted on carriages. The wheels are very broad and the tires are cleated. The larger calibers are mounted on platforms. They have to be transported in two or more loads drawn by tractors.

Motor Tractors.—The tractor most in evidence on this front is the caterpillar, originated in the United States. The drive wheels are elliptical and are provided with an endless chain of metal blocks, which give a large bearing surface and keep the wheels from sinking into the soft ground. It can cross a ditch or trench 1½ meters wide and an obstacle 3½ meters high. On meeting such an obstacle it lifts its forward part, climbs to the top and descends slowly on the other side. Its weight is 8 tons and it can draw a load of 5 tons over ground which would be impracticable for horses.

Tactical Use of Artillery.—The artillery on the Somme front is in action constantly, when adequate observation of the target can be had, the field artillery co-operating with the infantry, and guns of medium and larger calibers endeavoring to break down enemy attacks, combat his artillery, demolish parapets, shelters, communicating trenches, villages and woods that might serve as points of support or to conceal artillery emplacements, and to destroy roads and trails leading to the enemy's line from his rear. The heavy guns are also used for shelling, at irregular intervals, towns where troops may be billeted, the purpose being to compel them to bivouac.

In a city which we visited, 8 kilometers behind the lines, three houses had been destroyed by a 15-inch shell fired from a distance of 28 or 30 kilometers.

FIELD ARTILLERY—Continued

The bombardment of the trenches and the neutral zone at times reaches an almost unbelievable intensity. The holes dug in the ground by the projectiles are so densely grouped as to be tangent to each other, or even superimposed.

In the attack on the Delville Wood, projectiles fell at the rate of about 3 per minute per yard of front, while the Germans fired 100,000 in 24 hours on an 8 kilometer front.

Frequently both fronts are seen enveloped in a cloud of dust and smoke 200 or 300 meters deep.

The destruction of material is best shown by the accompanying photographs. It must be remembered that most of the heavy guns fire high-explosive shells and that many of the latter are provided with a retarding fuse which gives truly horrible destructive effects. The craters formed by the German 30.5 cm. howitzer have a diameter of 9 meters and a depth of 6 meters.

Location of the Pieces.—The light artillery is generally placed about one kilometer behind the first line of trenches. The medium and heavy guns are scattered over a zone extending to about six kilometers behind the trenches. Both kinds are provided with shelter from heavy artillery fire and are hidden from aerial observation.

The old principle that batteries should see and if possible avoid being seen does not apply to this class of warfare. The important thing is to keep hidden, since a battery, when once exposed to view from above, is destroyed within a few minutes. So true is this that when a gun position is discovered by the enemy the gunners go immediately to the shelters and there await the destruction of the piece. The gunners continue to serve the pieces only in the case of light artillery supporting an infantry attack.

Concealment from Aerial Observation.—The aeroplane has made the problem of concealing the batteries a most important one. Gun shelters are covered with straw, branches of trees, etc. The English frequently place frames over their guns and cover them with grass, leaves, pieces of canvas painted green, etc.

When an enemy aeroplane approaches a gun position, a sentinel gives warning and all the gunners hide in the shelters. It is considered better to keep hidden than to try to bring down an aeroplane with gunfire.

The dust raised by the discharge of a piece is very conspicuous. To keep it down the ground is sprinkled with water or oil, or covered with branches.

Changes of position can be made only during the night.

Modern Artillery Methods of Observation.—Artillery fire can be observed at greater distances than formerly because, the guns being of larger caliber, the projectiles are larger and the explosions therefore more easily seen. Both sides have perfected the methods of observation, sending observers provided with telephone and field glasses well to the front and resorting to aerial observation from captive balloons and aeroplanes.

Observers.—The observer is an officer, generally a subaltern. He is accompanied by one or two telephone operators who carry a field telephone. He advances to the first line trenches (if operating with light artillery), connects his telephone with the wires already laid in the communicating trenches, and from his observation post watches the fight taking place in the neutral zone. Thru his telephone operator, he communicates to the battery the time to commence and cease firing, kind of fire, corrections and variations in the intensity of fire.

Batteries of medium caliber also use this method of observation at times, but usually they depend, like the heavy guns, upon aerial observation.

Captive balloons are used for local observation on known objectives, while aeroplanes seek out enemy gun positions. The English have used the captive balloons to good advantage. The day we arrived at the front there were 32 of them on an extension of 11 kilometers. They are stationed at a height of 400 to 600 meters and some distance from the line. Their most dreaded enemy is the incendiary arrow dropped from aeroplanes.

The aeroplane flies about beyond the enemy's lines and, upon discovering an objective, throws a smoke rocket which leaves a track visible for some time. The artillery then opens fire upon the ground below the track of the rocket and the aviator signals the result. Most of the observing aeroplanes are provided with a light wireless outfit for sending only.

The Seismograph.—A very ingenious method of locating enemy batteries consists in placing at various observation points an instrument based on the theory of the seismograph, which registers graphically the air vibrations of the earth caused by the recoil of the piece. The graphical representations, by comparison with others made by known calibers at known points, indicate the direction and distance of the batteries.

Ammunition Supply.—In this war the railroad acts as an advanced depot from which the ammunition is carried forward in motor trucks. It is the use of the latter that makes possible the intense firing which the batteries keep up during practically all the daylight hours. The supply of a battery of four 12 cm. pieces, which formerly required 70 horses and some 30 wagons, is now accomplished by 4 motor trucks. The ammunition park and column of an army corps of 2 divisions, which formerly was about 14 kilometers long, with mechanical transportation extends over only 3 kilometers. The English have about 30,000 motor trucks in their supply service.

The 2500 projectiles which the Germans figured as the necessary reserve supply for each light artillery piece have been increased to 5000, the figure being limited only by the probable life of the piece.

CONCLUSIONS.—The conclusions deduced from the foregoing are:

The mechanical deficiencies expected to be found in the modern material subjected to such severe tests have not materialized. On the contrary, the hydraulic brakes and the recoil cylinders are now seen not only on the light field piece but also on all the new guns, whatever their calibre.

Motor traction has increased the mobility of heavy artillery, indicating a still greater increase in caliber in the future.

The artillery of the future will have to fire at distances much greater than those used thus far.

The necessity for heavy artillery and high explosive shells has become apparent.

Pieces must be hidden, not only behind vertical shelter, but also from aerial observation and attack.

There should be the closest possible coöperation between the artillery and the aeroplanes. Aviator units should be created for service with the artillery exclusively.

(To be continued.)

[Near Kovel. By S. N. A. *Voenny Sbornik,* Mar, '17. 5000 words. 2 maps.]

(This is an account of the author's experiences with a six-inch battery on the Austro-Russian frontier. Places are mentioned, but few dates, so that the author's story can not be connected up with any of the numerous military operations which have occurred near Kovel. The account relates entirely to field artillery, and little mention is made of the other arms of the service.

The first part of the article, which is written as a series of notes, speaks of the well concealed positions of the Austrian trenches, and this is contrasted with the Russian practice of at least occasionally placing the artillery in open fields in full view of the enemy. It is true than on such occasions the range was so great that no direct harm came to the Russians, but the ability of the enemy to determine the quantity and dispositions of the opposing artillery must have been of some value to them.

The author speaks of the efforts made by the Russians to so place the batteries in a battalion as to obtain flanking fire on the enemy's lines by the batteries mutually crossing their fire. The difficulties in obtaining suitable observation stations for the artillery in the wooded country, in which the operations were being carried on appear to have been considerable. Ranges were moderate, in general between 2000 and 3000 meters. Airplane observations were frequently necessary in order to secure results.

Heavy (6-in. batteries) field artillery were given in battle sectors having a front of about 700 yards to cover. 1500 shells per battery were furnished, which is apparently a day's supply, altho the author does not make this entirely clear. The 6-in. batteries were assigned to the task of destroying the hostile first line and communicating trenches; while the light artillery was detailed to cut the barbed wire entanglements and keep up a continuous shrapnel fire during the night to prevent the rebuilding of works destroyed during the day.

Notwithstanding some very severe shelling of the Austrian trenches, it occasionally happened that the enemy fired not a single shot during a whole day. It can be presumed that in such cases the Austrians had suitable dug-outs available to the shelter of which the entire personnel could be retired. The author comments on the fact that on one such day no movements of any kind could at any time be discerned in the hostile trenches.

When practicable the battalion commander had all the observation stations of the battalion established in the same vicinity. This reduced the time for occupation of positions and facilitated establishing and maintaining the communication system.)

FIELD FORTIFICATIONS

See

FORTIFICATIONS—FIELD

FINANCE, Military

["A Study of Appropriations for War." By Lt.-Col. Diaz. *Memorial del Ejercito de Chile,* July, '17. 3300 words.]

The development of an army depends above all upon the activity of the higher command and of the military administration. The organs of higher command are:

The Ministry of War, The General Inspection of the Army, The General Staff, Commands of strategic units and of Divisions, The Supply Department.

Different points of view are inevitable in all humans; differences in judgment are always to be expected between the heads of various military departments. These differences are largely neutralized by strict delimitation of the duties which correspond to each military authority. The maintenance of the military personnel in the best physical and moral condition has an economic aspect that cannot be disregarded, and this presupposes an intimate relation between organization and administration, a relation which the appropriation for war puts in evidence.

The appropriation for war includes two classes of expenses: personal expenses, which constitute pay and other emoluments given to individuals; and material expenses, which come from the acquisition of all classes of military supplies. It is therefore convenient to divide the appropriation into two parts, which may be called "organic" and "administrative."

The substance of the appropriation must always conform to three requirements, which are:

1st, That it must be based upon a good administrative system.

2nd, That it must indicate clearly the functions of the component elements of the army, leaving to each the necessary liberty of action.

3d, That it must permit individuals outside of the army a means of determining how the funds destined for given military necessities are calculated and determined.

(Here follows a tabulated account that does not permit of condensation, in which a plan is shown for an appropriation applicable to the Army of Chile.)

FIRE CONTROL

See

FIELD ARTILLERY—FIRE CONTROL

FLAGS

[Notes on Regimental Colours, Standards and Guidons. By S. Hastings Irwin. *Jour. R. U. S. Institution,* Aug, '17. 2000 words.]

FLAGS—Continued

(This article traces the development of the various regimental colors, standards and guidons of the British Army.)

FLAME PROJECTORS

[Sweeping Out Captured Dugouts with a Broom of Fire. *Scientific American*, Sept 8, '17. 425 words.]

The Germans employ the Brandrohr, or firestick, for the purpose of cleaning out the defenders of dugouts by subjecting them to a literal bath of fire. This firestick consists of a sheet iron cylinder, found in two sizes, 20 inches long and 4 in diameter, or 16x2. In both cases the metal is about one-twenty-fifth of an inch thick. The cylinder is closed at the bottom by a two-ply disk of lead and iron and is filled with compressed thermite. At the top it is sealed by a celluloid plate one-sixth of an inch thick, with six vents and a central orifice for the insertion of a stopper. The contents, thermite is a close mixture of powdered aluminum and iron oxide. The flame is started by the extraction of the stopper, and continues for about a minute, playing at a distance of two yards from the mouth of the cylinder. Because of the heat, the soldier is obliged to throw the cylinder as a grenade, or better, to fasten it to the end of a long pole and sweep out the concealed corners. For cleaning up captured trenches it has no rival, the victims must surrender or die.

FLAVINE

[A New Antiseptic. *Army and Navy Gazette*, June 30, '17. 300 words.]

Research at the Middlesex Hospital proved last November the valuable properties of flavine, a coal-tar derivative, as an antiseptic. The great value of flavine lies in its power to destroy micro-organisms without affecting even the most delicate tissues. Moreover, it is strengthened instead of being weakened by serum.

It has been found by test on certain bacteria to be 20 times more powerful than mercury perchloride, and about 800 times more powerful than carbolic acid. Both of these antiseptics destroy human tissues as well as micro-organisms, whereas flavine destroys only the latter. Unfortunately, flavine is manufactured on such a small scale that it is practically unobtainable. Flavine is an ideal antiseptic for military hospitals.

"FLECHETTES"

[Fléchettes. By 1st Lieut. Layriz. *Schweiz. Zeit. f. Art. u. Genie*. Jan, '16. 2500 words.]

(This is an extract from the original article by the author appearing in *Zeitschrift für das Gesamte Schiess-und Sprengstoffwesens.*)

[Airplane Darts. *Voenny Sbornik*, June, '16. Reprint from *L'Aérophile*. 300 words.]

The French use two kinds of darts to be thrown from airplanes. The first of these is a steel rod, pointed at one end, and grooved for two-thirds of its length from the upper end. The dart weighs about 15 grams, and when thrown from a height of 2000 meters will attain a velocity at the ground of 130-140 meters a second. The second form of dart is of about the same weight but has a weighted point and a twisted upper end.

(Nothing is stated in this article as to which of the two types in use is the preferable one. Probably both are equally satisfactory.)

FORT RILEY MOUNTED SERVICE SCHOOL

[The Mounted Service School. *Army and Navy Jour.*, July 28, '17. 100 words.]

The War Department has decided to suspend the course for field officers, the first and second year courses for company officers, and the course for non-commissioned officers. The courses for stable sergeants (or candidates for this grade) and for horseshoers will be continued.

FORTIFICATIONS

[The Service of Fortifications in the Modern State. By Col. Diaz. *Memorial del Ejército de Chile*, May, '17. 2900 words.]

(A study of the service of fortifications based upon the doctrines of Gen. J. Schröter.

The writer discusses this service under the headings of (a) Legislation; (b) Administration and construction, and (c) Cost of the works.

Figures are given of the German expenditures on fortified places. It is estimated that Germany expends annually on her 29 strong places and various military railroads but one and a half per cent of the total amount of the running expenses of the army.)

—Design and Construction of

See
FORTRESS ENGINEERING

—Field

See also
BARBED WIRE ENTANGLEMENTS
ENTRENCHMENTS

—Field—Obstacles

See also
BARBED WIRE ENTANGLEMENTS
ENTRENCHMENTS

—Field—Use of in European War

[Notes on Fortifications. By Cols. F. Echagüe and G. Benítez, attachés in France. *La Guerra y su Preparación*, Aug, '16. 6000 words. 51 figures.]

I. *Preliminary*. The speedy fall of Liége, Namur, and Antwerp to the besieging Germans has resulted in a somewhat premature belief that permanent fortifications are a thing of the past. Altho arguments will not be lacking to uphold this viewpoint, we believe that fortresses will continue to fulfill their modern mission of affording supporting points to armies in the field. Thus the recent invasion of Belgium was primarily due to the existence of the formidable Verdun-Belfort barrier of forts that guarded the French eastern frontier.

It should be observed that the Belgian strongholds, especially Antwerp, were lacking in artillery, and that their lines had been laid down before the recent strides in the development of heavy ordnance. Doubtless the future will see defenses located at greater distances

from the citadel; and places of military importance will be preferred as sites to great cities, with their costly edifices and large populations. However, the sweeping affirmations as to the obsolescence of forts are at least premature, and—we believe—incorrect.

Siege warfare has now been transferred to the battlefield. In spite of the manifest difficulties of moving such tremendous armies, it is hard to explain the contrast this condition of affairs presents with the *mobility* emphasized at the maneuvers of the last twenty years. In any event, it appears that the Germans, realizing in advance the need of strong defensive positions in the field, made careful provision therefor. In the campaign of the Marne, their trenches were deeper and better traversed than the light field-works of the French; and their guns were protected by emplacements, unlike those of their adversary. Even before that, the French offensive in Lorraine had found itself checked by the solidly fortified lines before Sarrebourg and Château-Salins; while the Allied forces in the Luxemburg had encountered a similar defensive system. On their march southward, the Germans left behind several battalions of sappers, who organized the line of the Aisne, before the possibility of a retreat was realized. Then came the extension of the wings of both armies toward the sea, and the eventual occupation of the entrenched lines whose trace has not been altered for two months. (Written Dec, '14.)

In view of these facts both combatants have adopted deep and narrow profiles; works are well traversed; communication trenches lead to shelters in the rear, and thence other trenches communicate with folds in the terrain and thus simplify the question of relief. Armored shelters are provided for machine-guns, and we have seen pieces of heavy artillery protected by enormous traverses enclosing store-rooms and bomb-proofs. The French Minister of War has issued a new fortification manual, replacing existing regulations, which provides for instruction in entrenchments for all troops liable to go to the front.

From observation posts and battery sites in Argonne, we have been able to see lines of trenches excavated in rear as a precaution. The entrenchments are invariably covered by from three to nine lines of wire entanglements, 50 meters in front, and sometimes by chevaux-de-frise. Towns in rear of the lines are organized with similar works, and with loopholed exterior walls. The spaces between the forts at Verdun are occupied by redoubts and trenches of various kinds. In Argonne, the opposite trenches are remarkably close together, as near as 40 meters. Under the circumstances, sapping and mining are the customary weapons of attack, since the adversaries remain invisible except for the moments of exposure during an attack. Observations are made by means of the periscope (illustrated).

II. *Principles Recognized in France.* The following principles are generally adopted by the French, and apparently do not differ from those of the Germans.

1. Trenches should be concealed from observation as far as possible; their relief reduced to a minimum; the soil given its natural appearance, resembling cultivated land in a farming country for instance; branches, sod, and even cloth of the color of the terrain utilized; and other methods of deception, such as dummy trenches, devised.

2. The destructive effect of large-calibered shells must be guarded against, by reducing the width of trenches, multiplying the traverses so as to form smaller compartments and more numerous shelters, as well for the first-line as for the reserve trenches; communication trenches being deepened.

3. If there is opportunity, the complete defensive position requires observation posts. drainage system, lavatories, niches for food, stores, and projectiles, and finally kitchens.

Figs. 1, 2, 3 illustrate three types of rifle trenches, deep, with minimum relief and a low parados for protection against bursting fragments.

Fig. 4.—A shelter for reserves, roofed with extemporized timber and covered with 20 inches of earth, sloped so as to facilitate ricochets.

Fig. 5.—Another shelter in the rifle trench.

Fig.6.—A bomb-proof called *perfecto,* for reserves, covered by a tier of 6-inch logs, then a foot of earth, another layer of logs placed perpendicularly, and another foot of earth on top. It appears that a German 6-inch shell fell into the center of one of these shelters, tearing up the first tier of logs, but without penetrating the second.

Fig. 7.—A method of utilizing the side slope of a road for a shelter. We have seen many such improvisations while traversing the high roads.

Figs. 8 and 9.—A machine gun shelter, one a type used at Verdun.

The only changes noted have to do with protection against enfilade artillery fire.

The number of traverses is increased, as also the munition recesses, for the convenience of riflemen.

Fig. 10.—A type of French trench constructed in rear of the Marne front as a precautionary measure.

Fig. 11.—A German trench on the battlefield of the Marne.

Fig. 12.—Shelter for German batteries; behind the center and on both sides of the gun carriage are deep holes for the cannoneers.

Fig. 13.—Shelter for German batteries which cut to pieces the 45th Division before Arcy; light parapets and continuous trenches.

Fig. 14.—French shelter trench at the Marne.

Fig. 15.—German and French kneeling trenches, most common at the Marne.

Fig. 16.—Trench periscope.

The line of trenches is established to fit the terrain, each with its shelter for reserves, with covered communication trenches and machine guns posted so as to flank the trenches. No accessory is lacking, from wire entanglements to the concealed deep pits with stakes and barbed wire.

III. *Principles Accepted in England*

[Here follow some text-book principles which present nothing novel.]

IV. *Field Fortifications. The use of ammonal and Bickford detonating fuse.* The manufacturers claim

FORTIFICATIONS—Continued

that No. 5 ammonal is much more powerful than nitro-cellulose or picric acid; that it is less sensitive; that it does not freeze; and that it can be exploded only by means of a detonator. Ammonal must be kept in hermetically sealed cans; the paper cartridges, contained in five-pound tins, suffice for ordinary purposes.

[Here follows a description of the familiar Bickford fuse, with directions for using it. Figures show the proper means of attaching it, and also good and bad practice in wiring the connections.]

Figs.. 24 and 25 show a quickly prepared land-mine, which can be placed at night.

Fig. 26 depicts an emplacement made for a battery of the 8th English Division. (Feb, '15.) Everything possible is utilized to conceal the batteries. Beside the piece are shelters for the cannoneers to occupy in case of the appearance of a hostile airplane. The batteries nearest to the firing-line are hidden behind a parapet of manure, and over the gun is a cloth covering.

Figs. 27 and 28 show Belgian trenches near Ramscapelle, in the flooded district. The first line trenches are at the very edge of the flooded zone, and are built above the level of the ground, with traverses from trench to trench.

Fig. 29.—Typical profiles of British first and second-line trenches. These both have a marked parados.

Fig. 30.—A section of English trenches adapted to a particular terrain, showing some ingenious shelters. The Belgian trenches in muddy soil were simple parapets with thick traverses, up to 6 meters, all made of sod. In the first line, the traverses contained shelters, and machine-gun emplacements with loop-holed steel plates.

The familiar types of "tin-can" and "hair-brush" hand grenades are illustrated in Figs. 31-33, with another more elaborate type. There is also shown a trench-mortar improvised from a 10 cm. cartridge-case. Other devices common in trench warefare are also mentioned.

Three views are given of a machine-gun shelter by the roadside commanding the bridge at Dieppe.

Fig. 40. — Second-line trenches near Pervyse in flooded territory.

Fig. 41.—Reserve line of trenches along the Loo Canal. These followed the bank of the canal, which served as a moat, on the further side of which were advanced posts for detachments of riflemen, reached by light foot-bridges from the main trenches.

Figs. 42 and 43. — Second-line trenches at Ypres, showing profiles and a machine-gun emplacement.

Fig. 44.—General plan of trenches and saps near Foucaucourt. The soldiers who man these trenches are generally under shelter, except for a certain number constantly watching at the loop-holes, who fire whenever any movement of the enemy (180 m. distant) is observed.

In Fig. 45 is shown the disposition of a field battery near Albert, in such a way that the pieces, revolving on a semi-circular platform, can fire against airplanes.

Fig. 46.—Type of portable chevaux-de-frise.

Fig. 47.—Method adopted at Mericourt of closing a gap in a system of trenches made by a ravine by means of wire entanglements.

V. *Works and Organization.* The traces of the various lines of trenches conform to no set rules, but are determined rather by the incidents of the fighting, by a forward surge at one point, by the occupation and strengthening of a mine-crater at another. Nevertheless, the first line may be said to comprise a continuous screen of trenches, in several parallel lines, connected by communication trenches, with an occasional center of resistance, a veritable net-work of trenches and machine-gun shelters. These supporting points are generally from two to three kilometers apart.

The German second line trenches have been located on reverse slopes, with only observation posts exposed on the crest. In the Champagne, such trenches have sometimes kept their entanglements unimpaired, and have held up many French attacks. The usual method of attack in this sector has been to advance over a 25-kilometer front, after an intense artillery preparation; the assailants may pierce the trench-lines at the first rush, but have to adopt veritable siege tactics against the formidable supporting points.

In the Vosges, fortifications are constructed very heavily, much timber being cut from the government forests for this purpose. The first line comprises three or four parallel trench lines, not over from 40 to 80 m. apart; these trenches are deep but not excessively narrow. (Fig. 49 shows trench arranged for a double tier of loopholes, constructed from boards and sandbags; deep shelters in rear). In the trenches are barriers, whose purpose is to confine to a limited sector any assailants gaining a foothold therein; ladders are kept in the trench as a means of exit when assuming the offensive. The trenches have their system of drain pipes, are often floored, and are made as comfortable as possible in all respects.

It is interesting to note that loop-holes are spaced ten or more meters apart; for it is the machine guns and hand grenades that are important in an attack, rather than the individual riflemen. Also, text-book rules in regard to lowering the parapet for the sake of concealment are of little value, since the trenches are so near each other.

The materials for entanglements come prepared for rapid assemblage. (A figure shows the usual arrangement for the high wire type). Stakes are driven with rubber-protected mallets. In occupying mine-craters, large chevaux-de-frise are used; the heavy American barbed wire is difficult to cut and can only be destroyed by artillery, but its great stiffness makes it hard to handle in exposed positions. One type of wire-cutter used is attached to a bayonet, and functions when the latter is thrust at the wire (illustrated).

Bomb-proofs are dug as deep as from 10 to 15 meters. They afford shelter against winter weather, as well as artillery, and must be well drained and ventilated. When the shelters cannot be driven so deep they are given concrete coverings. The concrete is sometimes

laid, in order to protect the workmen, by placing the bags of cement in place and throwing or pumping water on the pile.

[Notes on Field Fortifications. By N. Sbishnikov. *Voenny Sbornik,* Jan, '17. 6000 words.]

All defensive positions, whether fortified or not, should satisfy the following requirements:

1. Afford protection from the enemy's fire, while enabling the defenders to protect their own front by effective fire action;

2. Have effective obstacles in front of the position, to delay the enemy's advance.

3. Have facilities for launching counter-attacks;

4. Have necessary sheltered places in rear for communications, stores, reserves, etc.

In order to fulfill the first requirement, the defender's position should be as far as possible concealed from the enemy's view. It is sufficient if fire trenches have a field of fire to the front of 600-900 yards, but this distance should not be reduced below 200-300 yards. As a general rule, fire trenches under artillery fire should not be manned, and for this reason they should always be located where hostile artillery fire cannot reach them. But even if trenches are well masked, it is evident that when the hostile infantry arrives within 600-900 yards of them, the latter are likely to discover the defender's works, and these must then be occupied.

Obstacles in front of trenches should be so constructed that their presence will be concealed from the enemy's knowledge until his attacking infantry actually arrives at them; otherwise the obstacles are subject to destruction by fire action of the enemy's artillery.

Counter attacks should be undertaken by fresh troops held in suitable places for the purpose, such as woods, villages, etc., and should be launched after the attacker has been repulsed by the fire action of the defenders.

As stated above, positions selected for defense should be such that the attacking enemy shall at all times be subject to the fire of the defender's artillery, infantry and machine guns. Position for the defending artillery should consequently be so chosen as to cover all the foreground, altho not subjecting its own infantry to danger. To avoid the latter, the obstacles in front of fire trenches, which should always be under effective artillery fire, should not be so close to the fire trenches that both the obstacles and the trenches will lie within the danger zone of the exploding artillery shells or shrapnel. As stated above this condition will be satisfied when the obstacles are in general from 200-300 yards in front of the trenches. When they cannot be placed that far away it may be necessary or advisable to cross the fire of artillery batteries to afford proper protection to the fire trenches by its own artillery.

It is desirable, in occupying front line positions, to do so with the least force required to defend them, thereby releasing a larger number of men for reserves, enabling the defenders to seize at the proper time the initiative. Care must be taken, in providing shelter for reserves, that the character of such shelter shall not be such as to interfere with intended offensive action at a later period.

The position to be held should, prior to occupation by troops, be carefully reconnoitered by infantry and artillery commanders together, who should determine on the sector to be allotted to each of the major units of the command. This reconnaissance should be followed by a detailed reconnaissance made by unit commanders, after which the position should be occupied in the manner prescribed.

In past wars, especially in the Russo-Japanese war, it was sufficient for artillery to occupy a defiladed position in order to be reasonably safe from hostile fire, as in such positions only occasional shrapnel fire was to be feared. In the present war, however, such measures have been found to be quiet ineffective. The author observed that in the Warsaw campaign of October, 1914, the Germans sheltered their batteries with trenches having overhead cover, 4-5 feet thick, which was entirely sufficient to protect their guns from the light artillery projectiles of the Russian army. In consequence, similar protection should hereafter always be provided, care being, of course, taken that such cover does not interfere with the fire of the guns. Traverses between guns are always essential.

[The above article is based on experiences during the present war on the Russian front, where the distance between the opposing lines is as much as several miles. These lines are frequently out of sight of each other, and therefore differ radically from conditions in France.—Ed.]

[The Influence of the European War Upon the Art of Field Fortifications. By Maj. F. B. Wilby, Corps of Engineers. *Professional Memoirs,* July-Aug, '17. 25,000 words. Illustrated.]

The general principles which govern the fortification of a position are always the same and comprise provision for the most effective use of your own personnel and weapons, while restricting the effective use of those of the enemy.

Conforming to these general principles the objects to be sought in field fortification are: (1) *Observation* for effective fire on the enemy; (2) *Cover* from the enemy's fire; (3) *Concealment* from his view; (4) *Communication* for one's own troops; (5) *Obstructions* for the enemy's troops. New weapons and new equipment alter the relative importance of these objects, as well as the methods employed in attaining them.

The principal changes in weapons and equipment introduced during the present war are:

1. Increased caliber and range of mobile artillery and great number employed.

2. Enormous ammunition supply made possible by organization of factories and rail and motor transportation to the front.

3. Introduction of aircraft, providing control of artillery fire on concealed targets.

4. Increase in number of machine guns employed.

5. Use of grenades and high explosive bombs.

6. Introduction of liquid fire and poisonous, suffocating, lachrimatory and smoke-producing gases.

7. Armored motor cars and caterpillar tractors.

FORTIFICATIONS—Continued

The first four of these changes have had a very noticeable influence on the design of field fortification.

The primary lesson to be learned from the experience of the European War is the necessity for a knowledge of the principles of field fortification by all combat troops, and especially by their officers. In most cases the design and construction of trenches must be undertaken by the fighting troops under the supervision of their own officers.

The experience thus far indicates that a modern defensive position should be organized to include the following:

1st. A front line consisting at first of more or less disconnected firing trenches located at the best firing points, to be afterward connected up into one almost continuous line, consisting partly of firing trenches and partly of communicating trenches. This front line must be protected by obstacles—generally barbed wire—and by listening posts, look-out posts and machine guns. Shelters and dug-outs must be provided immediately behind the first line fire trenches, as well as traversed support trenches 25 to 100 yards in rear. Dressing stations, kitchens, etc., should be constructed in branches from the communicating trenches.

2nd. In case a determined attack is anticipated, a second and even a third line, prepared in rear of the first as rapidly as time permits. These lines may consist of a series of supporting points "prepared for all-around defense and surrounded by obstacles. They may be separated by intervals more or less weakly defended (but in which numerous dummy trenches are placed)."

3rd. Communication trenches connecting the second and third lines with the front, arranged for fire to the flanks and protected with obstacles perpendicular to the front.

The importance of concealment of all dispositions and works wherever possible, especially as regards observation from the air, has been emphasized in the European War.

In siting fire trenches, command of the immediate foreground is now considered more important than a good field of fire at longer ranges. As a protection from artillery fire and observation, trenches are often located on the reverse slope of a hill. A clear field of 60 yards is sufficient if more cannot be obtained without sacrifice of concealment.

The ordinary traversed trench seems to be the type of trace in most general use. Another trace used quite extensively is the "S and T" type, which consists of a number of short lengths of fire trenches connected to a lateral communication trench of sinusoidal design immediately in rear. Some new lines recently constructed show evidences of returning to the old bastion trace. Traverses should have a thickness of 6 to 7 feet and a length sufficient to overlap the rear of the trench at least 2 feet. The distance between traverses may vary from 4 to 8 yards, depending on the danger of enfilade.

As regards profile the tendency is to make the trench deep and narrow, with as low a parapet as possible, usually about 1 foot in height. The total relief of the complete trench is ordinarily 6½ to 7½ feet with a firing step 1½ feet wide. The vertical height from the firing step to top of parapet should apparently be more than the former rule of 4½ feet—probably about 4 feet 9 inches. The elbow rest is retained in all recent profiles, altho early reports were to the contrary. A parados in rear of the trench has been found necessary to give protection from the back blast of high explosive shell.

Altho many kinds of head cover and loopholes were formerly in quite general use on the Western Front, they are now being used more sparingly as experience has demonstrated their many disadvantages. Only a very few loopholes are now being constructed for the use of lookouts and snipers. Means for getting out of the trenches (sortie steps) in order to make or resist a bayonet attack must be provided.

While the importance of providing ample communication between all the elements of a command has always been recognized, the war has perfected many details of this branch of field fortification. One of the innovations is the lateral communication or supervision trench, which is now in almost universal use. It is placed 10 to 15 yards in rear of, and generally parallel to, the fire trench. A zig-zag or "wavy" trace is used for trenches for evacuating the wounded as the litters can be carried thru them more easily than thru the stepped or traversed trench, which are preferable for bringing up men and supplies as they are shorter. Arrangements must be made for defending the communicating trenches and preventing the enemy from advancing thru them. This includes machine guns or loopholed traverses, arranged to rake the straight portions, and portable obstacles for quickly blocking the passageway. A berm about 1 foot wide is left along both sides to prevent earth from falling into the trench, which must be kept clear and properly drained at all times.

One of the most important lessons of the war has been the necessity of obtaining, as soon as possible, effective protection against artillery fire. This protection is partially obtained by concealment wherever possible and by the avoidance of crowding the personnel together, but these must be supplemented as rapidly as can be done by the construction of material overhead cover for the entire force. Splinter-proof cover is now used very little; the first thing sought is protection against the high-explosive shell of the 3-inch gun. This is strengthened at the first opportunity. The necessity of having good shelters close to the firing trenches; cover of never less than 8 or 10 feet and often 20 to 25 feet thick; the provision of a number of small shelters rather than a few large ones; and the almost universal employment of two entrances to avoid the liability of the exit being blocked, have become well established practices by the experience to date. The best cover is always given to the telephone station. Due to the greater latitude permissible in locating the reserves, advantage may more often be taken, in their shelters, of concealment and natural cover. This is usually strengthened, as time permits, to resist the heaviest bombardment.

The wire entanglement has practically superseded all other types of obstacles and is used on an enormous scale. Entanglements are placed not only in an almost continuous line along the front of the position and of the different trenches of the first line, but also in front of the second and third lines, and, at frequent intervals, running back perpendicular to the front, dividing it into sectors.

The entanglement is almost universally located close to the firing trench, usually only 10 to 30 yards away. It is ordinarily in two belts and sometimes more, each belt being 5 to 10 yards wide with the belts some 20 yards apart. The outer edge must be 30 to 40 yards from the parapet to prevent grenades from being thrown into the trenches. The entanglement is made wide rather than dense, to avoid destruction by artillery fire, and is concealed, when possible for the same reason. Its trace is usually oblique to the trench to prevent its being used as a range mark by the enemy and to permit it to be enfiladed from the defenders' trenches. Entanglements are most effectively destroyed by high-explosive shell fire or by charges thrown by trench mortars.

All combat officers must have a knowledge of when and where to use machine guns and how to make arrangements for their effective use when brought into action. Machine gun positions must be concealed so as to avoid destruction by artillery and to introduce the element of surprise in their use. Ample cover against heavy artillery fire must be provided close to the firing position for the personnel, gun and ammunition, when not in action. Many alternate firing positions must be provided. The machine guns must not all be concentrated on the first line, many being placed in rear to be brought into action as the attack develops. In the attack, machine guns closely follow the attacking troops and are emplaced to assist in resisting the counter-attack.

The increased importance of artillery is one of the most marked factors in the conduct of modern warfare. This is because it is the only weapon that can cope with the defensive power of modern field fortifications. A well intrenched infantry line is practically immovable unless artillery is brought against it. On the other hand, any line can be taken if there be adequate artillery preparation prior to the attack. The use of aircraft renders it necessary to make every effort to conceal the location of batteries from aerial observation. As these efforts are seldom entirely successful, material protection must also be provided. This usually consists of ordinary gun pits, with bomb-proof cover for ammunition and gun crew when not firing. Arrangements must also be made for the prompt shifting of the location of a battery when its position has been definitely ascertained by the enemy.

The ability to command a view to the front is an essential of every field fortification. Means of observation must be supplied for sentinels or small detached posts, in front of the trenches; for sentinels in the trenches; for commanding officers of all units; and for artillery observers. In establishing observation stations, concealment is the prime consideration. Cover is secondary and is furnished only when it can be done without sacrificing invisibility.

In all kinds of trenches drainage is of the utmost importance. The drainage of the completed trench should be taken into consideration when the siting is done. Long continued occupancy of the trenches has made revetting of the interior slopes almost universal. The principal types of revetment in use are sand-bag, brush, hurdle, sod, wire netting and expanded metal. Enormous quantities of material are necessary for this purpose.

The guiding principles of the Art of Fortification and the elemental means of carrying out those principles have not changed. There has been, however, some change in the relative importance of these essentials, while the *methods* employed in securing the objects sought have been greatly modified and perfected.

[Report on the Defense of Gommecourt on July the 1st, 1916. *Jour. R. U. S. Institution*, Aug, '17. 9000 words. Six sketch maps.]

(The first part of this article is a day by day and hour by hour account taken from the war diary of the 55th Reserve Infantry Regiment (2nd Guard Reserve Division) for the period from June 24th to July 1st, 1916. The second part consists of remarks by the 55th Regiment and the third part, which is digested, tells of the lessons learned.)

Even an obstacle consisting of two belts of wire, each thirty meters wide, was unable to withstand the intense bombardment where not concealed from view. In spite of this, wire is all important in the defence of a position, as it protects the trench garrison from surprise attacks and minor enterprises up to the moment of the last preparatory artillery bombardment preceding the assault. It thus enables a considerable reduction to be made in trench garrisons, and preserves their defensive power.

When the time is short in which work can be done undisturbed by the enemy's fire, it is recommended that the obstacle be constructed first, as the construction of the trenches is easier to carry out under hostile fire. The obstacle should, of course, be concealed as much as possible and should therefore not be parallel to the fire trench; if time and labor are available it should be sunk below the ground level.

The destruction of the wire is rendered more difficult when the obstacles are placed at least 50 meters in front of the parapet. The destruction of the wire cannot then be carried out simultaneously with the bombardment of the trenches and it requires a separate expenditure of ammunition and time. Another way of accomplishing the same purpose is to construct it in two or three belts, with about 15 metres between belts.

Sentry posts are of the greatest importance and should be made of concrete. Concrete recesses dug deep into the parapet, from which the sentry can observe with a periscope, are also recommended, altho they can seldom be made in the fire trench under the

FORTIFICATIONS—Continued

enemy's fire. If the sentry posts are destroyed, observation must be carried out from the dugout entrances by means of long trench periscopes.

The heavy aerial torpedoes cause great damage to dugouts, but the deep tunnelled dugouts, with 5 or 6 meters of earth covering, were only destroyed by direct hits of 15-inch shells. In many cases both entrances were blown in and it is recommended that several dugouts should be joined up by underground galleries. In the trenches further back the dugouts should be made 7 or 8 meters deep and steps so constructed as to have at least 1.1 metres of earth above the first frame. In the good dugouts the troops were able to endure seven days' artillery bombardment without depreciation of their fighting power.

In order not to betray to the enemy the position of the final emplacements for the machine guns, it is necessary to change them frequently and not to open fire, at ordinary times from the emplacements which are intended to repel an assault. Every opportunity should be seized for obtaining overhead and enfilade fire from positions further back, and all positions suitable for this purpose should be reconnoitred beforehand and shown on a map.

The most important preparation for successfully repelling an attack consists in fostering and constantly maintaining a healthy and active offensive spirit among the troops.

By careful instruction in all methods of close fighting, each individual man must be trained to feel and know himself superior to the enemy, in order that the penetration into our position of a hostile attack must involve its annihilation.

The united efforts and energies of the troops holding a defensive position must be devoted to preparation for the final victory. No opportunity must be missed of causing the enemy casualties while at work, especially by wary, alert, and boldly led patrols, and by artillery and machine gun fire.

(Following are appendices showing the distribution of the regiment on July 1st, the casualties, expenditure of ammunition, condition of trenches, and a report of the medical arrangements.)

—Permanent

See also

ENTRENCHMENTS—SEMI-PERMANENT
SIEGE ARTILLERY

[Fortification and the Engineers. By Manuel Hernandez. *Revista Militar,* Aug, '16. 4800 words.]

Fortifications, together with mobile forces immediately available, are necessary for the protection of frontiers. By fortifications are meant, not continuous lines of works after the pattern of the Great Wall of China, but works protecting important rail and roadways, centers of communication, river crossings, defiles, etc. Frontier fortifications have their most important uses first, in furnishing protection during mobilization and concentration and second, in keeping open a gateway for the penetration of enemy territory. It is beyond discussion that under certain circumstances fortifications exercise a decisive influence in military operations. There is no contradiction between a system of frontier fortifications, well studied and well adapted, and the *spirit of the offensive.*

Fortifications should not induce, or condemn, armies to fight in trenches or behind parapets, but should permit the best utilization of the ground, mobility, and the capacity to maneuver with a view to taking the offensive. Frederick the Great liberated the art from the pedantry and schematism into which, to its discredit, it had fallen. The principles of the Great Monarch are exemplified today in the vast entrenched camps of Europe. Przemysl which, completely isolated, resisted the massed attacks of the Russians for more than four months, is an illustration of the modern concept of fortification as are also the lines in front of Verdun, where the most wonderful struggle in history is now being sustained. There is no intention of deprecating the difficult and manifold tasks of the engineers, but it should never be forgotten that these must not interfere with but serve tactical ends; the practical and theoretical education of engineer officers must inculcate this principle.

Both attacker and defender must know fortification, the one successfully to attack the other successfully to defend. The engineers must place their technical knowledge at the disposition of the other arms to end that victory may be gained. The true rôle of the engineer officer is not to put himself in the place of the commander or of the general staff officer, but *as an engineer* to be a most competent assistant and adviser to the commander-in-chief.

—Permanent—Armored Turrets

[Armor of Fortifications. *Rivista di Artiglieria e Genio,* Jan, Feb, Mar, '17. 115 words.]

When the fortifications of Douaumont were retaken by the French it was found that, altho the works had been heavily bombarded and numerous hits made on them first by the Germans and later by the French, the turrets were still intact.

—Permanent—For Coast Defense—Armament

See also

COAST ARTILLERY

[The Location of Coast Forts and Their Land Defenses. By Maj. H. E. Cloke, C.A.C. *Jour. U. S. Artill.,* May-June, '16. 2000 words. Illustrated.]

It has many times occurred to the writer that in the selection of sites for our coast fortifications, due consideration has not always been given to their land defense.

The fundamental principle of coast defense is to keep the enemy out. The mission of the enemy is invasion, destruction of customs revenue, to secure a base, seize our resources, and demand war indemnities.

This mission may be accomplished by naval or land attack. The theoretically perfect coast fort should be an island with precipitous slopes, so located as to command all harbor entrances, possessing superiority of fire over any attacking fleet, and self-sustaining against an indefinite siege.

That land defense has not been given adequate consideration in the past in locating our coast forts is

shown by the failure to utilize the islands, and the scattering about of batteries on the main-land with inadequate means of communication by which troops may be sent with safety from one battery to another.

(A series of three examples is given to illustrate the ideas of the author as to a proper location of coast defense batteries.)

—Permanent—Strategic Value of

[Fortifications in the Strategy of the Nineteenth Century. By Pietro Maravigna, Major of Infantry. *Rivisto di Artiglieria e Genio,* May-June, '16. 24,000 words.]

Armies and fortresses constitute the military power of a nation. The relation between these two elements varies according to circumstances, but fortresses must be regarded as always subsidiary to armies. A study of military history shows the rôle played by fortresses in the great wars fought from the time of the French Revolution to the present day.

The Wars of the Revolution and the Empire

Napoleon made use of fortifications either as supporting points for offensive maneuvers or as aids in holding important points with a small force. He classified them as barrier forts, for the defense of defiles and passes; frontier forts, for the protection of territory; depot forts, for the storage of supplies; and campaign forts, serving as pivots of maneuver. The last two he considered the most important. As to sea coast forts, he regarded them as purely defensive, for the protection of important harbors.

Napoleon did not allow himself to be tied to his own forts nor to be attracted by those of the enemy. He directed his operations toward a predetermined objective and gave to subordinate commanders the task of holding his own forts and observing those of the enemy. He followed this principle in 1806, making the Prussian army his objective, and using fortified places merely as pivots of operations and supply depots. After the victories of Jena and Auerstadt Napoleon devoted his efforts to the pursuit of the scattered fragments of the Prussian army rather than to the reduction of Prussian forts.

In 1813 Napoleon abandoned his previous practice and allowed his army, already inferior to that of his enemies, to be weakened by the detachment of garrisons of 25,000 at Hamburg, 30,000 at Dresden, 10,000 at Magdeburg, 30,000 in the forts of the Oder, and others in the forts of Italy and Dalmatia. The result was his defeat at Leipsic. The change of policy was dictated by political rather than military reasons. In the following year he expected the forts on the frontier to exercise a decided influence on the campaign by forcing the allies to detach large forces to observe the forts. This proved to be the case, but Napoleon would have fared better if he had not had the forts but had had their combined garrisons in hand for field operations.

The conclusion to be drawn from the Napoleonic wars is that fortifications, both permanent and temporary, exercised a great influence on the general plans of campaign, but that their influence on the actual progress of field operations was little or nothing, because Napoleon's maneuvers were always offensive.

The Wars for the Independence of Italy

After the downfall of Napoleon came a long period of peace lasting without serious interruption for more than thirty years. At the middle of the century the dominating ideas on the subject of fortifications were, first, the substitution of the polygonal for the bastioned system, and, second, the creation of intrenched camps composed of a central nucleus surrounded by a ring of detached forts, and capable of containing entire armies.

In 1848 Radetzky gathered his scanty forces in the fortresses of the Quadrilateral, where he reorganized his troops and awaited reinforcements. Here he based the plans which he later converted into action; here he awaited the attack of the Piedmontese army; and here he moved out to the counter attack by which he recovered what he had recently lost.

At that time the fortresses of the Quadrilateral were stone works, armed with guns in barbette. Peschiera was surrounded by small forts. Mantua had detached works and arrangements for inundation. Legnago was an important bridge head on the Adige. Verona was the most important, being a secure base for operations against the Mincio and towards the Tyrol.

The great need of Radetzky was to gain time. His opponents played into his hands by laying siege to the fortress instead of marching to cut off the reinforcements coming from Austria. The result was that Radetzky won and Charles Albert lost.

After 1848 the Austrians continued to improve the fortresses of the Quadrilateral and these works became an important feature of the campaign of 1859. The campaign was stopped midway and the fortresses did not have time to exert their full influence on the field operations, but even before the campaign ended the Franco-Italian army, numerically inferior to the Austrian, had been divided into three parts to attack different fortresses. The Austrians committed similar errors in garrisoning other places that had no important bearing on the campaign. The justification for these steps must be sought in political reasons.

The War of 1866

In this war Austria decided to act on the defensive in the two theaters of war, the Bohemian-Moravian and the Italian, because she was opposed by superior numbers in each theater and was also surpassed in quickness of mobilization. In the first theater her concentration was based upon the fortress of Olmütz, which was intended to cover Vienna. The Prussian advance into Bohemia forced Benedeck to abandon Olmütz. After his defeat at Sadowa he returned to Olmütz. Von Moltke left an army to observe him and moved on Vienna. Before the subsequent field operations were fully developed they were ended by an armistice.

In the Italian theater the concentration was based upon the Quadrilateral, and this fortified region exercised a great influence on the operations, not so much on account of its intrinsic importance as by the effect

FORTIFICATIONS—Continued

it had on the mind of Lamarmora. There were two courses of action open in dealing with the Quadrilateral, to make a direct attack on it or to go around it and advance on Venice. Unfortunately, the course adopted was a division of forces and an attempt to do both. The result was the defeat of the Italians at Custozza.

The Franco-German War of 1870-71

In this great war the French fortresses exercised a capital influence on both the strategical and the tactical developments. They rendered services of the highest importance to the French, but at the same time they exercised an irresistible and injurious force of attraction upon the French commanders and even upon the men. They did not have this influence upon the Prussians. Von Moltke did not concern himself overmuch with fortified places. He left detachments to besiege them, but he moved on with the main force. Paris was besieged in force not because it was a fortified place but because it was the capital and the heart of France. And von Moltke was prepared to withdraw the bulk of the besieging forces from Paris if that course had become necessary in order to meet new armies in the field.

The loss of Bazaine's army at Metz is a notable illustration of the baleful attraction exercised by a fortress. Political conditions entered into the problem, as a continued retreat meant the abandonment of large areas of the soil of France to the invader. The correct use of the fortress would have been made by occupying it with a small fraction of the army, delaying the enemy, forcing him to make a detachment to observe the fortress, and thereby gaining time for the main force to continue the retreat and receive reinforcements.

One important service rendered by the fortresses was the blocking of a number of railroad lines which would have been of great value to the Prussians. The importance of the fortresses to the French would have been much increased if they had been better prepared and better defended.

The Russo-Turkish War (1877-78)

In this war the offensive was taken by Russia. Her principal objective was Constantinople, to reach which three barriers had to be passed. The first was the Danube; the second was the Balkans; the third was the line of Tschatalja, where the Turks had constructed some temporary works, which were not defended.

The best line of action for the Turks would have been to oppose the crossing of the Danube. Instead of doing this, the Turks kept their principal army shut up in Bulgarian fortresses. Likewise, the army of Osman Pasha allowed itself to be shut up in Plevna, where it made a magnificent defense but perished nevertheless. Each force occupying a fortress succeeded in holding the attention of a force of the enemy several times its own size, but the Turks could not accomplish any decisive result in this way. They should have risked a battle in the open.

The Russians erred in besieging the fortresses instead of merely observing them. Even Plevna could have been treated in this way, leaving large numbers of men available for the advance on Constantinople. As a general conclusion, the effect of the fortresses on both combatants was negative and unfavorable.

The Anglo-Boer War

This war brought out two opposing strategical conceptions, represented by Sir Redvers Buller and Lord Roberts. The first believed in subordinating field operations to fortified places, and the second in making field operations independent of such places. The result proved the wisdom of making the hostile army the real objective.

During the first period of the war, the chief concern of Buller was the relief of the forces besieged in Kimberly and Ladysmith. For this purpose he divided his forces into two parts entirely independent of each other, with the result that each found itself inferior in numbers to its adversary.

In the second period of the war under Lord Roberts, the British took the offensive against the Boers in the field, and succeeded in not only causing the Boers to raise the sieges of Kimberly and Ladysmith, but also putting an end to the Boer offensive.

The campaign in the Transvaal was the last great war of the nineteenth century, but as the campaigns in Manchuria and the Balkans did not differ strategically from those of the preceding century it is instructive to make note of them.

The Russo-Japanese War in Manchuria (1904-1905)

The fortress to be considered in this war is Port Arthur. It was primarily a seacoast fort, strong on the side toward the water but weak on the land side.

Two plans of campaign were open to the Japanese, to seize at once the territory that had been the bone of contention previous to the conflict, and then turn on the combatant force of the enemy; or to profit by numerical superiority and move against the enemy at once, and then take possession of the territorial objective. Counting on the weakness of Port Arthur, the Japanese adopted the first solution. They occupied Korea and then sent a force against the fortress. The separation of forces resulting from this plan and the unexpected resistance of the fortress would have had serious consequences for Japan had Russia had the capacity to take advantage of her opportunities.

On the Russian side there was a conflict of opinion between the Viceroy Alexieff and General Kuropatkin. The former wished to send troops to the relief of the fortress. The latter was confident that the fortress could hold out for a long time, and proposed to leave it to its fate for a time so as to make the field army independent in its operations. The views of the Viceroy prevailed and reinforcements were sent toward Port Arthur.

Both armies were weakened by the detachments they sent to besiege or relieve Port Arthur, and neither was able to gain a decisive victory in the field.

The Balkan War (1912)

Satisfactory comment on this war is impossible, on account of the lack of exact information as to the operations. It is also to be noted that many of the developments of the war were due to political rather than strategical reasons. However, the influence of fortified places is shown by the large part that sieges played in the war.

Conclusion

The study of history warrants the following conclusions:

1. Fortified places should be employed only for the purpose for which they have been built.
2. As they are subsidiary to the army, it is necessary to sacrifice them to it and never sacrifice it to them.
3. The army must not be attracted by the fortress; the least possible force must be sent to attack or defend the fortress, so as not to cripple the army intended to operate in the open field.
4. The fortresses lose their value when they have no direct connection with the active operations of the army.
5. War of the present day assigns to fortification an offensive as well as a defensive rôle, depending on the maneuver to be executed.

The rational employment of fortification allows a nation or an army to reap the advantages of a certain moral security, an economy of forces and a saving of expenditure. It is necessary, however, that there shall be the most perfect efficiency in the works and the armament.

—Permanent—Use of in European War

See also
FORTIFICATIONS—FIELD—USE OF IN EUROPEAN WAR

[Douaumont. *Sphere,* Nov 4, '16. 500 words. Illustrated.]

The recapture of Fort Douaumont by the French on Oct 24 has given an opportunity to examine the remains of this work. The visible fortification has been entirely demolished, yet the underground galleries and chambers were found to be intact, and this in spite of the tremendous bombardment to which the fort has been subjected. Aeroplane photographs reproduced give evidence of the complete surface destruction wrought by bombardment.

[Fortifications and Their Rôle in the Present European War. By Lieut.-Col. Santiago Castro B. *Mem. del Ejército* (Chile), Jan, '17. 5500 words.]

(Note: This study deals only with the events that have taken place up to May, 1916.)

According to the Germans, the organization of a system of frontier fortifications may be forced by an offensive plan or by a strategic defensive.

Fortifications are used to screen the mobilization and concentration, and to protect the main lines of communications. Once the concentration is completed, fortifications serve to facilitate the advance of the troops and to lend moral support.

If during an offensive movement the troops meet a reverse, they can fall back on the line of fortifications until offensive operations are undertaken once more or until reinforcements can be brought up.

The capture of geographical objectives, however important they may be, or of frontier fortifications, does not bring a war to an end. This is accepted by both the French and the Germans.

"In forecasting the present war, frontier fortifications have been considered of the greatest importance. The large armies that will take part in the coming war demand that the struggle be terminated by rapid and decisive blows. A European war cannot last many years on account of the large expenditures called for by large armies and of the irreparable losses to the national resources due to the reduction of labor. This limitation as to the length of a war increases the value of fortifications. They will probably hold out while the war lasts."

It is true that the sieges of Strassburg, Belfort, Paris, and even Port Arthur, brought out the fact that unless the caliber of siege artillery was increased, concrete works could withstand successfully any artillery attacks. The fortifications of Liége, Naumur and Maubeuge were planned and erected on this assumption. While the French had taken no steps to increase the efficiency of their siege artillery, the Germans had planned and built, without making it public, their 28 cm. and 42 cm. howitzers, which destroyed the Belgian fortifications.

In the attack of fortified places, it may be said that the French and the Germans operate along different theories. The former believe in the carefully prepared attack, and they deviate from it only in special cases; the latter, owing to their superior methods of warfare, believe in rapidity of attack.

The influence exercised by well-established frontier fortifications in retarding or stopping an invasion cannot be ignored. In the Franco-German frontier, both nations have built fortifications which constitute a regular defensive barrier. Neither adversary planned a direct attack. When Germany attacked France, she did not advance from east to west; a northern route thru Belgium was taken. This plan was not one which was decided on the spur of the moment or was called for by later developments. On the contrary, it had been carefully studied and digested.

The fortified camps of Lille, Laon, La Fère and Rheims did not play the rôle assigned to them. Their evacuation was the result of the desire of the supreme commander to assemble their garrisons so as to increase the mobile forces. When it comes to the Belgian fortifications, no lessons can be learned from the operations leading to their capture. The defender did not play the game.

It is well to note that the line of fortified places comprising Toul, Belfort, Grenoble; the fortified region included in the triangle Langres, Dijon, Besançon, which with Rheims and Lyons constitute the second line of defense, remains intact. The reaction due to the battle of Marne enabled Toul and Nancy to repel all the German attacks, altho it is not believed that

FORTIFICATIONS—Continued

they could have withstood an attack from the 42 cm. It may be said that the existence of these fortifications is fully justified. After three years of war they are still intact.

In studying the eastern theater of the war, attention may be called to the siege of Przemysl. Tho the Russians captured it, the Austrian defense was a glorious one. For several months this fortified place withstood the bombardment from the Russian heavy artillery, which never gained superiority of fire, nor did it destroy any of the forts. They were blown up by the Austrians on account of the strategic situation. When Przemysl was recaptured by the Austrians, five of the forts were taken by assault.

The capture of the Russian fortifications on the Vistula, Niemen and Narew is the only example in military history where one of the strongest fortified lines was swept away by the strategic maneuvering of an advancing field army. The fall of Warsaw, which resulted in the fall of Wilna, may be compared to that of Liége and Antwerp. As a result of these latter operations the gates to France were opened. The occupation of Poland, and of the fortified places from Novo Georgievsk to Kovno was the result of the fall of Warsaw.

As regards coast fortifications, there are two well established principles:

1. In an engagement between modern coast fortifications and a fleet, also modern, the probabilities of victory are on the side of the fortifications.

2. A naval attack against coast fortifications requires the co-operation of land forces.

In support of the first mentioned principle, it may be stated that the powerful English and French fleets have refrained from attacking the coast fortifications of the Central Powers. The island of Heligoland, key to the navigation and anchorage of the German fleet in the North and Baltic Seas, is the bulwark of the defense of these coasts.

The statements contained in the second principle are supported by the results of the Dardanelles expedition. The failure of this expedition may be attributed to the small landing force (about 80,000 men), to the lack of ammunition and to inadequate field artillery, and to the lack of energy displayed by the troops worn out after a long trip.

General Humbel in an article published in the *Figaro* of December, 1914, has recommended the separation of the fortress artillery from the field artillery, and the consolidation of the fortress artillery with the engineers.

History repeats itself: Belfort under Colonel Denfort Rochereau in the war of 1870-71, and Verdun under Generals Pétain and Nivelle in 1916, demonstrate that activity, energy, courage and stubbornness of a defender cannot be swept away by methods or by heavy artillery.

FORTRESS ARTILLERY

See also

COAST ARTILLERY

FORTRESS ENGINEERING
—Resistance to Gun Fire

[Examination of Belgian Fortress Concrete and Firing Experiments. Anonymous. *Schweiz. Zeit. f. Art. u. Genie,* Apr, '16. 750 words.]

(A transcript from *Zeitsch. d. Vereins deutscher Ingenieure.*)

The Belgian fortresses were not constructed of reinforced steel-concrete, but principally of masonry and natural cement. No reinforced steel concrete fort has as yet been subjected to the test of war. Experiments made with natural and artificial stone blocks show that those 20 cm. in thickness are usually splintered by small arms fire under 100 m., whereas reinforced concrete plate only 10.5 cm. in thickness have resisted perforation at a distance of 30 m.

FORTRESS WARFARE

See

SIEGE OPERATIONS

FRANCE
—Aeronautics

See

AERONAUTICS—MATERIEL—FRANCE
AERONAUTICS—USE OF IN EUROPEAN WAR—FRANCE

—Army

See

EUROPEAN WAR—FORCES ENGAGED—FRANCE
JOFFRE, GEN. JOSEPH JACQUES CESAIRE

—Army—Artillery

See

FIELD ARTILLERY—FRANCE

—Army—Engineers

See also

JOFFRE, MARSHAL JOSEPH JACQUES CESAIRE

—Army—Supply and Transport

See

RAILROADS—FRANCE

—Army—Uniforms

See

UNIFORMS—FRANCE

—History

See also

AMERICAN REVOLUTION
FRANCO-PRUSSIAN WAR
GERMANY—HISTORY (Article: Soissons, etc.)
GREAT BRITAIN—HISTORY (Article: "Anglo-French Relations")
NAPOLEONIC WARS—1813-15

[Anglo-French Relations. By Maj.-Gen. T. F. Lloyd. *United Service Magazine,* Nov, '16. 3200 words.]

(A résumé of Anglo-French Relations from 1189 to 1453; continued.)

[Anglo-French Relations. By Maj.-Gen. T. F. Lloyd. *United Service Magazine,* Dec, '16. 3200 words.]

(A continued study from the death of Henry II., 1189, to the end of the Hundred Years' War, 1453.)

[The Irish Troops in the Service of France, 1691-1791. By Col. C. N. Watts, *Journal R. U. S. Institution*, May, '17. 4000 words.]

(A brief history of each of the Irish regiments in the French service during the century between the expulsion of James II of England and the French Revolution. The organization and service of each unit is given. Of historical value only.)

—Munitions—Manufacturing Facilities

See

MUNITIONS—MANUFACTURING FACILITIES OF—FRANCE

—Navy

See also

BATTLESHIPS—COMPARATIVE POWER OF

—Railroads

See

RAILROADS

—War Ministry

See also

ADMINISTRATION, MILITARY — WAR DEPARTMENT AND MINISTRIES (Article: "The New Ministries in France")

FRANCO-PRUSSIAN WAR

[The War of 1870-71. (Continued.) By H. M. *Schweiz. Monatschrift aller Waffen*, Sept, '17. 1000 words.]

The organization of the 16th French Army Corps was decided upon at the beginning of October. The whole undertaking suffered from the irresolution of the War Ministry. Units and commanders were shifted until they did not know to what organization they belonged. Headquarters were moved to Tours. The Corps was originally to consist of 2 divisions of 2 brigades each, at Blois and Tours, total 20,000 men. Later another division, organized at Bourges, was added. Then a cavalry division of three brigades was to be organized, one of which was under Tripard at Vendome. An attempt was made to raise the necessary artillery and technical troops at Tours. The Corps commander was to be left all freedom of action, but whenever he issued an order he received counter instructions. The Corps was ordered to reconnoiter as far as possible, to protect the population against German requisitions, and to cut the German communications. The War Ministry directed that single regiments were not to be opposed to the enemy, because of their poor morale, and then on Oct 10 several of these units were risked singly near Artenay. The artillery was to consist of 3 field batteries of 4's and 4 batteries of 12's (rifles), as well as 3 horse batteries of 4's (rifles) of 4 guns each. The matériel was to be obtained wherever possible. Nineteen cartridges were available for each chassepot gun. As to engineers, a staff, two companies, and a park were sent to Tours. When the third division was added the companies had to be broken up. The administrative personnel was in part taken from the navy. Such sanitary personnel as was available was assigned. When, on Oct 17, part of the Corps had to leave Tours, the auxiliary troops were not yet organized and trains were lacking. About 600 wagons of questionable serviceability were secured by contract, but the number needed for the Corps was 3000. Clothing, arms, accouterments, and tentage were scarce. The Corps was finally armed at the end of November, but there were no spare parts.

From Oct 14 Tripard's cavalry brigade and some other detachments covered the Corps between Loire and Loir. Tripard had been ordered to guard Chateaudun, but received a number of contradictory orders culminating in his moving to Vendome. He sent a few troops to Chateaudun. The fall of Orleans caused some more movements back and forth. On the 15th he withdrew from Chateaudun. On the 17th Pourcet assumed command of the Corps in Blois. Learning of the retreat of the 15th Corps to the Sauldre, he requested that artillery officers be sent him, without whom he could not support Tripard, who now commanded the covering troops on the left bank of the Loire. The artillery officers were not available. (To be concluded.)

FREDERICK THE GREAT (of Prussia)

[Frederick The Great. By Maj. G. W. Redway. *United Service Magazine*, Dec, '16. 2800 words.]

(Biographical sketch.)

FRENCH AND INDIAN WARS (American)

See also

QUEBEC, CAPTURE OF

FRONTIERS

—Defense of

See also

MOUNTAIN WARFARE

FUEL

—For Motor Transport

See

MOTOR TRANSPORT—FUEL FOR

GASES, ASPHYXIATING

See

ASPHYXIATING GASES

GASOLENE

See also

MOTOR TRANSPORT—FUEL FOR

GENERAL STAFF

See

STAFF—GENERAL STAFF

GERMANY

—Aeronautics

See also

AERONAUTICS—GERMANY
AERONAUTICS—MATERIEL—GERMANY
DIRIGIBLES—GERMANY
DIRIGIBLES—USE OF IN EUROPEAN WAR
GOTHA BIPLANE
SUBMARINES—GERMANY

GERMANY—Continued

—Army

See also

CHAPLAINS (Article: "The Activity of the Chaplain in the German Army")

CLAUSEWITZ

EUROPEAN WAR—FORCES ENGAGED—CENTRAL POWERS

EUROPEAN WAR—LOSSES—GERMANY

HINDENBURG, FIELD MARSHAL VON

MACHINE GUN—TROOPS—ORGANIZATION—GERMANY

—Army—Artillery

See also

AERIAL ARTILLERY

—Army—Cavalry

See also

MACHINE GUNS—TACTICS (Article: "Machine Gun Sections in the German Cavalry")

—Army—Infantry

See also

INFANTRY—TACTICS—ATTACK

—Army—Officers

[Anxious for Peace. *Canadian Military Gazette,* Oct 9, '17. 200 words.]

Because of very great losses of officers earlier in the war, the Germans are finding it necessary to conserve their officers. One of the chief grievances of the German prisoners is the failure of their officers to take risks. This fact is made apparent in hand-to-hand fighting in which the British officers invariably lead their men, while the German officers seldom do.

—Army—Personnel

[German Military Leaders. *Review of Reviews,* Jan, '17. 2000 words. Illustrated.]

With inferior numbers, Germany has not only kept her own soil practically clear of invaders during two and a half years of war, but her own armies have swept over Belgium, northeastern France, Serbia, and, finally, Rumania. Her success has been attributed to interior lines, superior railways, to the proficiency of the German soldier in the ranks, and to marked superiority in leadership.

German campaigns are planned by the Kaiser, the Minister of War, and the Great General Staff, and by them are selected the generals to carry out these plans. The two great German reverses—the Marne and Verdun—have each been followed by the dismissal of the Chief of the General Staff.

The flexible battle lines of the east have given opportunity for the three outstanding military figures—Hindenburg, Mackensen, and Falkenhayn—to gain their prominence.

Hindenburg first came into prominence thru the great victory of Tannenberg. He was the principal figure in the campaign that won Poland in 1915 and is the Chief of the General Staff. In his second and unsuccessful Polish campaign, Hindenburg, it is charged, needlessly sacrificed his men; and in the third he allowed the Russians to retire week after week in perfect order. He is seventy years old, and his "platform" is to make war mercilessly and defeat the enemy that confronts him. As Chief of Staff he has a program.

Mackensen was one of Hindenburg's principal lieutenants in East Prussia. In May and June, 1915, he led the armies that swept the Russians back out of Galicia. These operated from the south against Warsaw (July 15 to Sept 15, 1915) in the campaign that drove the Russian 200 miles beyond Warsaw and cost them heavily in casualties and prisoners. He then commanded the Serbian operations, and the successful completion of three tremendous offensives in a single season stamped him in the opinion of most authorities as Germany's greatest military leader.

Falkenhayn, appointed Chief of Staff when von Moltke retired in October, 1914, after the Marne, held that post until dismissed after the failure at Verdun. He was then, however, sent to co-operate with Mackensen in the operations against Rumania. A brilliantly conducted campaign followed.

Another notable figure is Gen. von Ludendorf, Hindenburg's quartermaster-general. He is Hindenburg's right-hand man and the two are inseparable.

The western front is divided into three sectors. The northern sector is commanded by Duke Albrecht of Württemberg, 51 years old; the center sector, which includes the Somme, is commanded by Crown-Prince Rupprecht of Bavaria, 47 years old; and the southern sector, which includes the Verdun front, is commanded by the Kaiser's son, Crown-Prince Frederick William, only 34 years old. The latter has had Gen. von Haeseler, 80 years of age, as his adviser.

The original leaders of the dash on Paris have ceased to be mentioned in dispatches. Von Kluck was wounded in March, 1915, and never returned to the front. Von Emmich died a year ago, and Field-Marshal von der Goltz died of fever in Turkey after the abandonment of the British attack on the Dardanelles.

—Army—Schools and Training

See also

EDUCATION, MILITARY—GERMANY

TACTICS—INSTRUCTION AND TRAINING—TACTICAL PROBLEMS

—Army—Uniforms

See

UNIFORMS—GERMANY

—Coast Defense

[The German Coast Defenses on the North Sea. *Svensk Kustartilleritidskrift,* Part 1, '17.]

(A translation of an article in the *United Service Magazine,* by Hector C. Bywater.)

—Food and Commodity Prices and Supply

See

EUROPEAN WAR—FOOD AND COMMODITY PRICES AND SUPPLY—GERMANY

—**History**

See also

European war
Franco-Prussian war
Frederick the Great (of Prussia)

[Soissons, 1814, 1870-71, 1914-15. By Lt.-Col. Freiherr v. Welck. *Jahrbücher, deutsche A. u. M.*, June, '15. 4400 words.]

For the third time in one hundred years German troops are on French soil. In 1814-15 the purpose was to free Germany, with the help of Austria, Russia and England, from the French yoke. The war was successfully terminated by the capture of Napoleon. In 1870-71 the Germans, without allies, defeated France, which had begun the war, and annexed Elsass and Lothringen. In 1914 the French, actuated by desire for revenge, and other powers, actuated by jealousy, concluded an alliance and attacked Germany from two sides. On the west, the theater of war is almost the same as in 1870. One of the fortresses of this region is Soissons, on the Aisne. The history of Soissons shows the changes in warfare during one hundred years.

1814.—After Napoleon's defeat at Leipzig, the Allies followed him over the French boundary. Feb 1 he was defeated at La Rothière, and retreated to Troyes, followed by the main army of the Allies under Schwarzenberg, while Blücher marched down the Marne Valley. Napoleon inflicted a defeat on Blücher, and then turned against Schwarzenberg. It was decided that Blücher should, after junction with the corps of Bülow and Witzingerode, cross the Aube and march directly on Paris, thus drawing Napoleon away from the main army. Blücher resumed his march Feb 24, drove back Marmont, and crossed the Marne Feb 27. The advance guard under Katzler and the corps of Kleist reached the vicinity of Lizy on the Ourcq, where they were compelled by superior forces to retreat. Accordingly Katzler and Kleist withdrew on the road to Soissons. Meanwhile Bülow at Soissons and Witzingerode at Rheims were placed under Blücher's command. Napoleon on Feb 27 turned against Blücher, and was thus drawn away from Schwarzenberg. On Mar 1 Napoleon reached la Ferté-sous-Jouarre. Blücher now concentrated his army on the Chateau Thierry-Soissons road, in order to be nearer to Bülow and Witzingerode. On Mar 1 Bülow and Witzingerode advanced to attack Soissons. The attacking force consisted of 45,000 men.

This fortress was built on the bastion system, with towers, on the left bank of the Aisne, with a bridgehead on the right bank. The garrison was 1600 men. The fortress was surrendered without fighting, Mar 4. The capture of Soissons facilitated the crossing of the Aisne, and on Mar 4 Blücher concentrated his army on the right bank. Napoleon characterized this surrender as an incalculable loss. He exaggerated, however; Soissons was merely a fortified town without outworks, and did not dominate the surrounding country. Even without the loss of Soissons he could not have prevented Blücher from crossing the Aisne.

1870.—After the fall of Sedan, the Germans renewed their march toward Paris. Soissons was strongly defended. The 14th Army Corps appeared before the place Sept 14, and demanded its surrender. The demand was refused, and as only field pieces were available, the corps passed around the city, leaving only a cavalry squadron to protect communications. On Sept 23 a detachment of a Landwehr division undertook the investment of the place. Tho the Germans could reach Paris before beginning the bombardment of Soissons, nevertheless the capture of the place was necessary to insure possession of the railroads and to further the collection of taxes and requisitions.

Altho it was regarded as the "Key to Paris," the fortress had been only slightly strengthened since 1814. The order to prepare for defense was received on the day after war was declared. It was lacking in armament and equipment, but no one believed that the Germans would even cross the frontier, and no preparations were made until after Sedan.

On Oct 1 the investing force under General von Selchow was reinforced, and the investment was completed Oct 6. The bombardment began, Oct 12, with thirty-six siege guns. The defenders replied energetically. A summons to surrender on the 13th was refused. The bombardment continued. A breach was made in the fortress; the morale of the garrison was destroyed; ruin, death and famine attacked the populace; and on the 16th the place was surrendered. The troops were made prisoners of war, but the officers and civil officials were paroled. At the time of the surrender the officers had lost all control. The troops of the garrison plundered the commissary and became drunk. The garrison consisted of 4500 men.

Both in 1814 and in 1870 the fortress surrendered in a few days, when it could have held out much longer.

[A Nassau Centennial. By Nassovius. *Jahrbücher, deutsche A. u. M.*, June, '15. 3200 words.]

1915 was a centennial year for the Nassau troops. In 1815 the military administration was centralized and for the first time the troops of the three principalities fought in the same theater against Napoleon.

When the French were driven to the Rhine in 1813 the Prince of Nassau joined the alliance against Napoleon. The troops of the Duchy were relieved from service with Napoleon and went over to the other side. The Conscription Law of 1808 was now given wider effect. A third line regiment, a Landwehr regiment, and a Landsturm of 36,400 men were formed. The Reserve companies of the Landsturm were equipped for field service. The militia companies were armed with a variety of weapons. The new forces were principally composed of volunteers. Five battalions crossed the Rhine to besiege Mainz in December. At the same time the army of Orange-Nassau was formed into one regiment, and in February, 1814, a Landsturm was formed by conscription. The members had to furnish their own weapons. After the 1814 peace treaty the Landsturm and some of the line troops were demobilized. One regiment of the Duchy remained in the Netherlands, attached, by treaty, to the Dutch army.

GERMANY—Continued

Feb 26, 1815, Napoleon left Elba. A mobilization order was issued to the First Line Regiment of the Duchy. The regiment was increased by a third battalion (Landwehr) and the companies in battalion were increased from four to six. The regiment was recruited to full strength and started for Brussels June 6th. It consisted of 71 officers and 2474 men. The 2nd Regiment (3 battalions of 6 companies, strength 89 officers and 2738 men) was joined with the Orange-Nassau Regiment of 2 battalions (39 officers and 1427 men) in the 2nd Brigade of the 2nd Netherlands Division. A company of volunteer cavalry of Orange-Nassau (3 officers, 166 men) was also included in the brigade. These forces fought at Quatrebras. At Belle Alliance the 1st Regiment was in the center under the Prince of Orange, and the other Nassau troops were in the left wing under Picton. The Nassau troops suffered heavily. On June 23 the 1st and 2nd Regiments were united and assigned to the 2nd British Corps.

After Waterloo, the 2nd Regiment returned to the Netherlands Division; the Orange-Nassau regiment was broken up, part of the personnel becoming Prussian subjects and the remainder uniting with the 1st Regiment, which was reorganized in two battalions. In 1820 the 2nd Regiment returned from the Netherlands and was similarly reorganized. The Nassau Ducal Brigade now consisted of two regiments of two battalions each, and a garrison company. Each battalion consisted of one grenadier, four jaeger, and one flanqueur companies. Artillery, of which the guns captured at Waterloo formed the nucleus, was added in 1822. The Brigade and the Ducal Military School were placed under the commander-in-chief. For internal police there was a Reserve, formed out of the Landwehr, of one battalion of eight companies.

The War of 1815 taught Nassau two lessons: (1) that a new conscription law was necessary, and (2) that artillery was needed. The first need was filled by the Law of 1816. It required universal service of all subjects, six years with the colors, of which, however, only 32 months were spent on duty. In the case of exempted persons the entire service was on paper. Persons having certain property qualifications could offer substitutes. Non-commissioned officers of six years' service could serve as such, receiving substitute money. The second need was filled by the formation in 1822 of a battery of six guns and two howitzers.

[War Finances of Frederick the Great. *Schweiz. Zeit. f. Art u. Genie,* Aug, '16. 1000 words.]

[A transcript from *Militar Zeitung,* giving an historical account of the manner in which Frederick the Great managed his war finances. His maxim was "the last dollar will win the war." Contributions were levied, taxes raised, money debased, and notes issued. In this manner he collected 170 million talers, to defray the cost of the Seven Years' War, which cost him only 140 million.]

[Text of Germany's Proposal to Form an Alliance with Mexico and Japan Against the United States. Supplied by the Associated Press as an authentic copy of the German Foreign Minister's note to the German Minister in Mexico. New York *Times,* Mar 1, '17.]

Berlin, Jan 19, 1917.

On the 1st of February we intend to begin submarine warfare unrestricted. In spite of this, it is our intention to endeavor to keep neutral the United States of America.

If this attempt is not successful, we propose an alliance on the following basis with Mexico: That we shall make war together and together make peace. We shall give general financial support, and it is understood that Mexico is to reconquer the lost territory in New Mexico, Texas and Arizona. The details are left to you for settlement.

You are instructed to inform the President of Mexico of the above in the greatest confidence as soon as it is certain that there will be an outbreak of war with the United States, and suggest that the President of Mexico, on his own initiative, should communicate with Japan, suggesting adherence at once to this plan. At the same time, offer to mediate between Germany and Japan.

Please call to the attention of the President of Mexico that the employment of ruthless submarine warfare now promises to compel England to make peace in a few months.

—Military Conditions in

See also

EUROPEAN WAR—CONDITIONS OF BELLIGERENTS

[German Reserves Fully Analyzed. By Hilaire Belloc. *Land and Water,* Nov 2, '16. 8000 words. 1 sketch.]

(The figures given in this article were compiled by the writer from data secured from authoritative sources during a recent visit to the continent.—ED. *Land and Water.*)

A just appreciation of the German man-power has been the foundation of all sound judgment upon the war from the beginning. Great national wars must always ultimately turn upon the factor of man-power, granted equality in material, supply, training, discipline and organization between the opposing parties.

The security of the German lines depends upon their resting safely upon either distant flank. They must be held as a whole. So to hold them demands a certain minimum of men. Below that minimum is the breaking point. Germany now has a larger number of men in the field—and therefore a correspondingly weaker reserve of man-power—than ever before. She has also organized a much larger number of divisions. A German division at war strength consists of some 20,000 men.

A normal division at full strength would have, besides auxiliary troops, three regiments of infantry, each regiment being of four battalions, each battalion of four companies. The German infantry company is 250 strong. This would give 12,000 bayonets to the division. 203 divisions form to-day the German field army, of which 129 are on the western front and 74 upon the eastern front. Counting men in the auxiliary services and on the lines of communication, the armies

of the German Empire aggregate over five million men. Of men in reserve to replace wastage constantly going on there are from one-fourth to one-fifth of that number. There are four categories only in the *full* total of men behind the organized army who can be called upon.

These are:

1. The men in the depots:	
(a) The bulk of class 1918..........	320,000
(b) The cured wounded temporarily in the depots......................	20,000
(c) The men formerly rejected and called for service after re-examination	70,000
(d) The remainder of class 1917.....	150,000
Total	560,000
2. Men capable of service before next summer but who have not been trained (boys yet immature, etc.)...........	150,000 to 160,000
3. Wounded and sick now in hospitals who will have been returned to duty cured by August, 1917..............	600,000
4. The exempted fit (men necessarily absent in mines, munition factories, shipbuilding yards, on the railways, etc)..	600,000

As only the first three categories need be considered the grand total of reserve man-power is between 1,310,000 and 1,320,000. This is the situation at the present moment (November, 1916).

[War Notes. By Capt. H. M. Johnstone, R.E. (retired). *United Service Magazine,* Dec, '16. 4800 words.]

The Germans have left, in man-power, first, a vast number of able-bodied men in their hands as prisoners and they have no scruple in compelling these men to work for them at all and every kind of labor indiscriminately. This frees a great many Germans and Austrians for the ranks of the army. Another source for them of substitute labor is found in the populations of the countries they have overrun, Belgium, northeast France, Serbia, and Poland. The law is that these people can be made to work for the upkeep of their own districts and for the maintenance of the subsistence of their own inhabitants. The Germans force the inhabitants to work and their produce goes greatly to the benefit of the Germans, and the national man-power for war is thereby greatly increased.

Germany hopes to draw several thousand Poles to her armies by declaring Poland an independent kingdom. The German "classes" of 1916 and 1917, that is, the young men who in these years reach the age of twenty, would provide somewhere about one and a half millions of recruits, but 30 per cent. of the 1916 class have already volunteered and been used. The number remaining is made up to a good two millions by wounded and sick who have been cured and are again fit for the field. Four millions of men still work at home, and of these a million more of military age could be drawn into the army at a pinch. But these things can only be done at the expense of the complete exhaustion of Germany.

Taking the war in general, the beating of the Germans depends greatly on whether the British can put their soldiers *hors de combat* at a daily or monthly rate higher than the natural growth of their male population, but it does not depend entirely on this. Many of their units are already diluted in value thru inclusion of physically unfit and of half-trained men, while in most of the armies of the Entente there is going on not only increase of numbers, but maintenance of a good standard of physique, along with full training of every man before bringing him down to the trenches.

[Germany's Reserves. *Army and Navy Gazette,* June 30, '17. 400 words.]

A French military writer calculates the total German effectives, in the field and in the interior, at 5,435,000 men, with available reserves not exceeding 755,000. He estimates the monthly German contingent at 200,000, which is less than the monthly loss.

It may be questioned whether the number, 2,200,000, estimated as rejected because unfit for service, is not too high. It is even more difficult to judge how many men may be made available by substituting women.

—Military Policy of

See also

European war—Military lessons of the
Preparedness for war—Mobilization of natural resources—Germany

[Rome and Prussia. By C. F. Marriot. *United Service Magazine,* May '17. 2000 words.]

(The parallel between Rome and Prussia ends with the Navy Bill of 1900. Hannibal sought to destroy Rome by forming a vast league against her; Prussia has formed a mighty coalition against herself.)

—Munitions—Manufacturing Facilities

See

Munitions—Manufacturing facilities—Germany

—Navy

See also

Submarines—Germany

—Railroads

See

Railroads—Germany

GOTHA BATTLE PLANE

[Germany's Gotha Battleplane and Its Machine Gun Tunnel. *Scientific American,* Sept 22, '17. 700 words. Illustrated.]

Germany's latest innovation in the air is the Gotha three-seater battleplane. It measures 75 feet between wing-tips and is 38 feet in length. The machine is of the biplane type, and the upper wings are provided with huge ailerons which extend slightly beyond the lower wings.

The body is of special interest. The two passengers (one in front of and one behind the pilot) sit

GOTHA BATTLE PLANE—Continued

at the axis. The pilot's seat is placed at the left, leaving room for a gangway for the passage of the occupants from one end to the other. The armament consists of three machine guns. One of them, placed in a turret in front fires forward and both above and below the wings. Two other machine guns run in grooves on two transverse tubes fixed behind the rear passenger—one above the body and the other nearly level with the floor, which is here deeply hollowed out to form the gun tunnel. It is thus possible for the Gotha to fire forward, at the sides, underneath, upward, and to the rear; indeed it is a machine for all-round fire.

The bomb dropping apparatus is arranged to carry twelve to fourteen bombs, or a total of eight hundred to one thousand pounds of explosives. These bombs are carried inside the body of the machine between the pilot and rear gunner's cockpits. Arranged horizontally on racks in two tiers on each side of the fuselage, the bombs can be released in quick succession. When one bomb is released the next above automatically slips into the position vacated. In addition, two bombs are carried under the forward cockpit in tunnels built into the floor of the fuselage and held by spring clips or collars. Essentially this machine is a bombing plane, and as such has displaced the Zeppelin as a raider against England.

The power plant of the Gotha consists of two Mercédès motors of 260 horsepower each, placed one on either side of the body at a distance of six feet from the axis. The motors are encased in armored nacelles, each of which carries its own landing gear which serves as a part of the landing chassis for the entire machine.

But the main feature of the Gotha is its machine gun tunnel which eliminates the so-called "blind spot" under the tail. The machine guns of most airplanes cannot be brought to bear on a target on line with the tail members, since to hit the target would mean shooting off one's rudder or elevator. It is this very feature which determines aerial battle tactics to a great extent; for the airman maneuvers to reach a position back of his opponent, either above or below the tail, from which he can shatter his opponent with machine gun fire while enjoying immunity from retaliatory fire.

The fuselage of the Gotha, however, is vaulted below like a tunnel, along which a machine gun is trained to meet a "tail attack."

GOTHA BIPLANE

[Aeroplane Raids. *Army & Navy Gazette,* Aug 11, '17. 1200 words.]

The Germans understand that only large, powerful machines, with speed and climbing power and carrying capacity, are useful for raiding purposes. The raid of July 7 consisted of such machines, and by keeping in formation they were able to defy the attacks of our airmen. A favoring wind enabled them to approach with a minimum of warning, and after dropping their bombs they were lightened so that they could climb out of reach of the British machines.

The Gotha machines are similar to our (British) best-known large airplanes. (Certain general characteristics are desc-ibed—span 77 feet, length 40 feet, pusher type, slight dihedral angle, projecting and balanced ailerons, etc.) The gunners, both front and rear, can fire upwards and downwards, as well as on their own level or right and left. The bottom of the fuselage is open for a considerable distance, enabling the rear gunner to fire downwards as well as to the rear. The machine carries a crew of three.

These features make the Gotha a formidable adversary, invulnerable to light machines, particularly when flying in formation, when there is no room for maneuvering. An attack from the rear may come under the fire of two machine guns, because a passage allows the forward gunner to pass the pilot and man one of the rear machine guns.

[The German Gun Tunnel Gotha. *Aerial Age Weekly,* Sept 24, '17. 790 words. Illustrated.]

The German Gotha biplane has been found to be one of the most difficult of the German machines to attack owing to the fact that it has practically no blind spot. The blind spot is the position that a pursuing airplane gets into that makes it impossible for the pursued plane to fire at its pursuer without blowing its own tail off. Heretofore the scout machines could attack the big gun planes from a position just back of their tails without much danger, because the tail of the big machine shielded the small machine. To stop this the Gotha designers have placed a vault like recess in the fuselage of the machine which permits a machine gun to fire on any machine coming from the rear. This tunnel is hardly visible until one comes very near to the machine. From front to rear the Gotha is equipped as follows: Gunner-observer with a wide range machine gun and two large bombs; the pilot with two bomb racks just behind him holding a dozen bombs, each fifty lbs., fixed so that they can be dropped as desired; the after gunner's seat and the gun tunnel under it. The gun tunnel operator works while lying prone on the floor of the fuselage. The forward gunner can leave his seat and pass by the pilot to work the gun in the gun tunnel. The span of the machine is 78 ft., the chord is 7 ft. 6 in., the gap is 7 ft. 2 in. and the length is 41 ft. The motors are 6-cylinder Mercédès, developing 260 h.p. at 1400 r.p.m.

GRAVES (Military)

—Registration of

[The Registration and Care of Military Graves During the Present War. *Journal R. U. S. Institution,* May, '17. 2500 words.]

Attached to each of the various British expeditionary forces is a separate and complete organization whose sole duty is the finding, marking, and registering of the graves of officers and men who die on active service, and the laying out and maintaining of cemeteries behind the lines.

The Graves Registration Commission was formed in 1915 under the direction of the Adjutant-General's office in France. It now consists of an inquiry branch

and headquarters in London and the Land, Survey, Gardening, and Photographic Departments which, together with the executive headquarters of the various graves registration units are in France.

The London office, in charge of the Director of Graves Registration and Inquiries, is a department of the Adjutant-General's Branch, War Office; it includes within its administration the units in France and those in Egypt, Salonika and Mesopotamia. All inquiries as to the location of graves are handled here. The special searches for graves and the necessary researches in cases where faulty reports describing officers and men are received are conducted by this office. Weekly reports are made to the London office by the various units on the different fronts.

The Land Department was established to settle such legal matters with the French authorities as were required for the acquisition of cemeteries under the French law which presented all burial plots as a free gift to the British nation, the British Government becoming responsible for their maintenance.

There are now about 400 of these burial grounds in France and Belgium. They are looked after by soldiers unfit for general service. The sites are selected before the cemeteries are required, if possible, and are accurately surveyed and laid out. The work of beautifying them is carried out under the direction of the Botanical Adviser, a staff officer who was formerly a director of the Royal Botanical Gardens.

The Photograph Department supplies, on request, photographs of individual graves to any relative of the fallen soldiers.

The graves registration field units, commanded by a captain, with two subaltern officers, clerks, orderlies, and the necessary motor transportation, are six in number. Five are distributed along the front and the sixth is responsible for the whole lines of communication area. These units are charged with complete control of the registration in their particular sectors, also with the care of the cemeteries therein. They have nothing to do with the carrying out of burials, the chaplain or the officer in charge of burial parties being responsible for the temporary marking of the grave and for the proper report, with full description of the soldier buried. The graves registration officers keep in close touch with the chaplains of fighting units and, as soon as burials are known to have taken place, they follow up, bringing with them the wooden crosses for erection over all graves which can be identified. These crosses are simple ones of creosoted wood, about four feet high with a stamped metal inscription and of light, yet durable, construction.

In the conditions of modern warfare, the difficulties of identification are often insurmountable. In many cases identification discs have been lost and to remedy this each soldier now carries a double disc. These discs are of different colors, one being suspended from the neck and the other attached to the first by a short cord. The lower one is for removal with a view to identification of death, so that, where burial is impracticable when the body is first found, there may still be a means of identification at the time of burial.

All dead are removed to the rear for indentification and burial whenever possible. In spite of all precautions, there must inevitably remain a certain number of unidentified burials, the records of which can only take the form of lists of men known to have fallen within certain areas. Accurate records, with map references, are kept of all reports of burial, and exhumation at the end of the war may identify many of the fallen. Such exhumation is strictly prohibited at present.

The original officer personnel of the Commission was formed by granting commissions to various men of Red Cross units at the front. New officers are chiefly professional men who are either partially unfit or over age for other service.

[New Army Service Formed. *Official Bulletin*, Aug 27, '17. 250 words.]

By authority of Congress, the President has ordered the organization of a Graves Registration Service under the Quartermaster Corps. This organization will consist of 1 captain, 1 second lieutenant, 1 first sergeant, 3 quartermaster sergeants (senior grade), 1 mess sergeant, 1 supply sergeant, 4 sergeants, 5 corporals, 1 mechanic, 4 wagoners, 1 cook, 7 privates first class, and 22 privates. Transportation, 4 escort wagons and 18 draft mules.

GREAT BRITAIN

—Aeronautics

See

Aeronautics—Great Britain
Aeronautics—Materiel—Great Britain
Aeronautics—Organization and administration—Great Britain

—Army

See also

Borgard, Gen. Albert
European war—Forces engaged—Great Britain
European war—Losses—Great Britain
India—Army
Pay, Army—Great Britain
Pensions, Military—Great Britain
Watson, Jonas

[The Service of the General Staff in the English Army. By Maj. Ernesto Luque. *La Guerra y su Preparación*, Aug, '17. 7200 words.]

Recruiting

Recruiting is one of the most interesting aspects of the General Staff study. By dint of persistency and tenacity the British have assembled millions of men, and made the best of the voluntary enlistment system which is so unfitted to fill the great demand for men. Their recruiting machinery at the beginning of the war was able to handle a maximum of 30,000 men annually.

In August, 1914, England had 300,000 men mobilized, including the Regular Army, the Reserve, and the Special Reserve. These, with 250,000 partially instructed territorials, brought the number up to 550,000, of which 100,000 were in India and the other Colonies.

GREAT BRITAIN—Continued

The defense of the Islands and formation of expeditionary forces was left to 450,000 partially instructed men.

Before the war England had 500 recruiting officers, which number was raised to 7000 on the declaration of war, and this force was able to recruit 250,000 men in one week.

The usual difficulties attendant upon a mobilization were felt, but England was so unready that no barracks, quarters or tents could be secured for her new army. The General Staff had to improvise everything. By sending home soldiers' families, quarters housing 175,000 men were extended to a capacity of 262,000, and later by renting buildings and quartering troops, this number was raised to 800,000.

Shoes, clothing, and personal equipment had to be improvised. Armament and instruction presented even greater difficulties.

There were two ways of handling the situation: by placing all recruits not immediately necessary in the reserve, to be called as needed, or by raising the standard of selection. After much vacillation the latter scheme was adopted. It unfortunately worked too well. The second week the system had been in force recruits for the regular army were cut down to less than one-third the number accepted the first week, and this fraction finally reached one-ninth. The spirit of the people fell, men began to think a personal sacrifice was not necessary, and did not apply for enlistment.

Finally it became necessary to stimulate the nation's enthusiasm. The effort to do this marked the beginning of the second recruiting campaign.

In comparing the military spirit of England and her Allies at the beginning of the war it must be remembered that both France and Russia had been invaded; they also had compulsory military service—which England never did have. Besides this the invasion of Russia and France was done in such a way that every citizen capable of bearing arms considered it his first duty to drive out the invader. The English people, in the meantime, lived in the belief that their duty consisted in maintaining the supremacy of the seas, and giving industrial aid to the Allies.

The English idea of sufficient military force was a large and powerful fleet, a well instructed, volunteer, regular army, for Expeditionary Forces, and a less instructed volunteer army for home defense.

The English have no pre-disposition for war unless they feel, as they now do, its absolute necessity.

In its second recruiting campaign the English Government began by putting public opinion in favor of what promised to be a terrific war. Every means of doing this was used, and once the initial difficulties of arming, equipping, etc., were conquered, attention was given the idea of compulsory military service and training, and the people familiarized with the idea.

In the second recruiting campaign the first thing done was to remove the recruiting restrictions, then the men of greatest prestige in England started an active campaign for recruits from the country districts, the effects of which were felt in the most remote corners of the United Kingdom.

The Prime Minister, as head of the Liberal party, and the leaders of the Conservative and Labor parties, united all their political resources in the service of this cause, creating, under parliamentary auspices, a Central Council in London with representatives in every county, city and village of Great Britain.

A voluntary personnel was organized to classify and register the answers to 8,000,000 letters which had been sent out, one to every young man of age in the kingdom. Personal contact was retained with these young men thru meetings at which the most powerful apostles of the campaign presided.

Conservatives, radicals, laborists and Irishmen, separated before the war by individual ideas, went over the country in caravans seeking recruits. Even the Prime Minister found time to address the people. Wounded soldiers from the trenches spoke to the people with good results.

Automobilists placed their machines at the disposal of the Minister of War and were used to transport recruits. Proclamations and posters were exhibited at every public place. Famous artists appealed to every class, and to every side of human nature. The moving picture machine and the theater played their part. In all 54 million prospectuses were sent out, 12,000 meetings were held and 20,000 speeches delivered.

From the beginning of the war Lord Derby, present War Minister, made Kitchener see the possibilities of recruiting many men if means were provided of having friends and neighbors grouped together. This idea was sanctioned in the formation of Pal Battalions, organized, equipped, fed, clothed, quartered and instructed at the expense of individuals or municipalities, who were reimbursed in due time.

The results of this plan were surprising, Lord Derby himself organized 3 battalions of 4000 men in 3 days, and altogether 111 battalions of infantry, 84 of artillery, and 48 of engineers were organized.

In the meantime the territorial army had offered itself for foreign service and joined the expeditionary forces. By July, 1915, before the first year of the war was ended, more than 2 million men were recruited by the voluntary system, or more than 6700 men per day.

Formation of the National Register

Tho the effort was immense, enough men to keep the ranks filled, were not recruited. Besides, England's vital industries were perishing, and those of no military value were flourishing. So, on July 15, 1915, the formation of the national register, was ordered.

The time chosen for this order was an opportune one. Public opinion had been properly prepared, and the people realized that this was the best way of helping the families of men who had already died or been incapacitated.

This order was the first step taken to arm the nation. By its provisions all inhabitants of Great Britain, male and female, between the ages of 16 and 65 stated

to proper authorities their occupation, and their ability to do any work in the service of the country. On the completion of the register the number of men of military age suitable for active service was known, as well as the number fitted for work in military manufactories and industrial plants necessary to the life of the country.

The register was made by the local authorities, assisted by 150,000 volunteers, who collected and classified data and made the proper selections. No new organization was necessary for this important work.

The papers pertaining to those men between 18 and 41 years, not employed in war work, were collected and returned to their respective recruiting districts.

After these preparations had been completed, a final effort to recruit men was made. This campaign was intended by Lord Derby to familiarize the people with the presence of troops, and to that end many parades and reviews were held on the streets and in public places.

Group System

Lord Derby's chief innovation was the division of all men into 46 groups according to age and civil status. The first 23 groups included all bachelors from 18 to 41 years old (one group per year) and the last 23, all married men similarly arranged. The men available for service could thus be determined at any time. In the last recruit campaign Lord Derby promised that if enough men could not be secured compulsory service of some sort would be resorted to. He also promised that no married man would be recruited until all the bachelors had presented themselves.

On Dec 11, voluntary recruiting was done away with. In the four months previous two and one-half million men had been listed, and 275,000 others recruited. There were still many slackers, and many Quakers who refused to fight on account of religious scruples.

In January, 1916, the compulsory service law was passed which applied to slackers—in order to insure the promises which Lord Derby had made the married men.

By a gradual process of familiarization the compulsory service law was adopted in 18 months in a democratic country which had always been opposed to any such interference with personal liberties.

Concentration of Troops on the Continent

Once the men had been found, the next thing was to put them on the continent—which movement necessitated two operations—the transportation over sea, and on the land.

Altho England had a large merchant marine, her ships were not all suitable for the transportation of men, stock, cannon, and vehicles, and it took some time to alter the ships and prepare ports of embarkation and debarkation.

The men that England has at the front to-day have meant the transportation of 4 million tons and the employment of 2700 ships. The size of this fleet alone indicates the work that the General Staff and Admiralty must have done in order to systematize it as it is to-day.

The section of France in which the British are fighting was the gateway to Central Europe, and had many railroads, wagon roads, and canals running thru it, which facilitated transportation and distribution of troops.

Quartering British Troops in France

The General Staff knew very little about this subject at the beginning of the war, as there had been no need for the knowledge. At present, British regulations prescribe the quartering of ten men per man in rich agricultural districts and 5 or 6 in cities and rich manufacturing centers. In some cases temporary shelter was provided. Bivouacking has been done away with as it is unsanitary. Aerial observation was the cause of devising the Nissen hut, a very warm and sanitary form of shelter made of zinc lined with wood. It is de-mountable and easily transported.

The General Staff in the Duties of Command

Generalship of to-day is more complicated than it has been in any previous war. To-day, a commander in chief must base his actions on what he is told rather than on what he sees. His difficulties are increased by the greater number of men engaged. He will find it impossible to deal with details of execution. General Haig, in the Battle of the Somme, left the responsibility of the action to his 4th and 5th Army Commanders. A commanding general may spend months in the preparation of an offensive, yet he must not intervene in the few moments of its execution. The qualities of generalship are a quiet tranquillity above the emotions and impressions of battle, quick and accurate power of observation, judgment, decision and action.

General Staff Duties

These deal with the disposition of men and matériel before and during battle. At present the General Staff is busiest during the preparation for an offensive, and after its successful termination. During its actual execution the Staff simply keeps informed.

Transportation and communication are great Staff problems.

Signal Corps in the British Army

Means of communication have kept pace with scientific discovery and invention. To-day everything from the carrier pigeon to the wireless telephone is used.

Great Headquarters uses wireless for communication with Field Army, Cavalry Division, and Mounted Brigade Headquarters. Ground lines communicate with Infantry Division headquarters, and aerial lines with advanced bases. Infantry Division Headquarters communicate with Cavalry and Artillery Brigade Headquarters by telephone. Local communication is carried on by visual signals and messengers. Cavalry Division headquarters has wireless communication with Brigades and visual signals and messengers for local necessities. Telegraph is used for general inter-communication. Brigades use the telephone and telegraph to lower units, and finally regiments use telephone, visual signals and messengers or orderlies.

All these means of communication are united in the British Signal Service.

GREAT BRITAIN—Continued

—Army—Artillery

See also

ARTILLERY

FIELD ARTILLERY—HEAVY—GREAT BRITAIN

—Army—Engineers

See

ENGINEERS—HISTORY—GREAT BRITAIN

—Army—Officers

[The Higher Command. *The Fortnightly Review,* Mar, '17. 700 words.]

There is a growing feeling among Territorials and New Army officers that they have not sufficient representation in the higher ranks of the army. England has now been at war for more than two and a half years and all officers who have been serving continuously at the front are now practically regulars. Yet at the present moment, out of the large number of able men now to be found in the Territorials and New Army, those who have risen to higher rank than that of battalion commander can be counted on the fingers. A very few have been given brigade commands; but from the division upwards, all the higher units are monopolized by regular army officers. The same criticism applies to the directing staffs of our armies in the field.

Regular officers say that they are professional soldiers and as such must know more about war than amateurs; but this may be answered by recalling that all officers are amateurs in the face of the present conditions. Trench warfare was unknown to the staff war college students until the Germans stopped General Joffre on the Aisne. We are waging war on new principles and the organizer of victory is he who has the best head and the longest vision. It should be the business of the war cabinet to make sure that the best brains of the country, whether in the old or new armies, are now being used to obtain victory. What seems to be wanted is gradually to infuse new blood into the old stock, and by so doing, give the direction of the war a more complete organization than it has hitherto had. There must be no interference with the executive command of soldiers in the field, but in regard to matters of war policy, war preparation, and choice of personnel for carrying out the law of the people Parliament cannot and ought not to surrender its control.

—Army—Sanitary Service

Sec also

EUROPEAN WAR—SANITARY SERVICE—GREAT BRITAIN

[The British Medical Services. *The Canadian Military Gazette,* Jan 23, '17. 2900 words.]

The present British Medical Services, which are not a result of the present war, but an organization built up in its present form as a result of lessons from South Africa and Manchuria, have stood the strain of the incredible expansion necessary to deal with an army of more than five million men. The Director General of the Services, thru his staff, directs the movement of every medical unit in France, Mesopotamia, Egypt and the Balkans. These Services consist of the Royal Army Medical Corps, the Canadian, Australian and New Zealand Army Medical Corps and medical units of other colonial forces, in all of which the organization is the same as in the Royal Army Medical Corps.

RECONSTRUCTION OF THE R. A. M. C.

(a) *Introductory.*

The first great step in this reformation was carried out by Lord Middleton after the South African war and consisted in a sanitary service to deal with preventable diseases. The second step was the formation of R. A. Medical Corps for service with the territorial force, and both of these changes have been of great importance in the present war.

(b) *The Sanitary Service.*

In the South African war, as in all previous wars, the losses through disease exceeded losses from wounds. In that war, to each regiment was attached a medical officer assisted by some trained stretcher bearers, but there was no organization to deal with preventable disease. The first reform gave to the regimental medical officer one N. C. O. and four men specially trained in water duties, and each battalion detailed one N. C. O. and eight men to receive training in sanitary duties. In order that the line officers might co-operate, a School of Army Sanitation was opened at Aldershot, instruction was arranged for at Sandhurst and Woolwich, army medical organization was studied at the Staff College, officers were examined in this subject for promotion to captain and were required to lecture to their men on sanitation, and the commanding officer was made responsible for the surroundings of his battalion.

The good results of this reform are manifest in the present war, and a rigid inspection of all food supplies has been combined with careful sanitation and the provision of good water. Laboratories have been established at convenient points near the front so that chemical and microscopic examinations and analyses are quickly and readily obtained, and a committee of sanitary experts travels from place to place and gives advice on difficult sanitary questions. By this means the prevention of disease has become almost a routine, and its detection a certainty. Areas once filled with enteric fever have almost been cleaned of that disease, tetanus has almost ceased to exist and other infectious diseases, such as cerebro-spinal meningitis, held in check. The sick rate of the troops has been greatly reduced, the proportion of fit fighting men being greater than was ever anticipated.

(c) *The Territorial R. A. M. C.*

One defect of the British Medical Corps has always been its inability to meet war-time demands, but this defect was remedied after the South African war by the formation of a Territorial Royal Army Medical Corps, similar in all respects to the R. A. M. C. At the same time a Home Hospital Corps was formed whose duty it was to take over the home medical establishments when the Regular Corps was called into the field. A Territorial Nursing Service was also formed. This new organization was so arranged that it became operative upon mobilization, and is capa-

ble of indefinite expansion. There are to-day ten thousand officers and seventy thousand enlisted men in the Regular Corps and its co-operative branches, many of whom have given up lucrative practices to put their skill at the service of military hospitals in England and France.

—Army—Service in India

[Suggestions for Removing the Difficulties Encountered by British Units Arriving in India from the Point of View of Regimental Interior Economy and the Comfort of the Men. By Maj. F. B. Jeriss, F.R.C.S., (Edin.) R.A.M.C., (T.F.) *Jour. United Serv. Institution of India,* Apr, '17. 4000 words.]

The Great European War caused a great influx of Territorial forces into India. This injection of a large body of men into strange surroundings and unusual conditions of climate and living requires the most careful precautions to prevent serious results in the way of unnecessary discomfort, hardship and disease.

The Territorial soldier differs from the regular. He has had less training and the physical standard is lower. The Territorial is primarily a civilian and less adaptable than the regular. Many units came without regular adjutants or other experienced officers and had much to learn by experience. Many men were immature youths and some were over age.

The conditions were new to the officers and undoubtedly the government of India was sorely tried to meet the wishes and grievances of the Territorials.

Much could have been learned on the voyage out if there had been officers and n.c.o.'s of Indian experience attached to the commands. Medical officers lectured to the troops, but real knowledge requires Indian experience.

For troops traveling in hot climates, plenty of room on trains should be provided, and troop trains should have preference over ordinary traffic. Electric fans should be provided in all cars.

The Territorials were new to everything and at a disadvantage as compared to the regular recruit, who joins an experienced unit. Some regular officers were attached to the Territorials and their assistance was of great value.

The cooking and feeding arrangements in barracks were primitive. There is danger of disease in dirt, dust and flies, and the natives are unsanitary in their habits and customs. Screened dining halls, a central cook house, greater supervision and the use of battalion instead of native cooks, a fully equipped scullery, and a pantry for storage of crockery are suggested as improvements which could be easily applied, and which would contribute to comfort, health, economy, and efficiency. Late dinner should be served in the hot season.

Bathing arrangements presented difficulties on account of the scarcity of water. Every barracks ought to have a bath house of inexpensive construction, with hot water. As a camp expedient for washing where wood was not available for building benches, a ridge of earth was raised about two feet high with shallow depressions scooped in the top. These were lined with a piece of canvas about 18 inches square. A condemned tarpaulin furnished excellent material for this purpose. The regimental barber should be under strict supervision.

The ration supplied is excellent, but the amount of fat is low, and the arrangements for purchases could be improved.

The problem of amusement is one deserving attention, and indoor work and play should be encouraged as a means of recreation in the hot season. One battalion had an "Arts and Crafts" exhibition at the close of the hot season, with prizes to stimulate interest in knitting, carpentry, map-making, landscape targets, etc.

An army fights on its stomach, but it marches and fights too on its feet. Fitting of boots should be given close attention, and free issues of prophylactics for the treatment of sore and tender feet should be made. Canvas shoes should be issued free, and the battalion chiropodist should inspect feet, in addition to the medical officer, and report to the company officers.

—Army—Supply and Transport

See
SUPPLY AND TRANSPORT—GREAT BRITAIN

—Compulsory Military Service

See
GREAT BRITAIN—MILITARY POLICY OF

—Food and Commodity Prices and Supply

See
EUROPEAN WAR—FOOD AND COMMODITY PRICES AND SUPPLY—GREAT BRITAIN

—History

See
AMERICAN REVOLUTION
FRANCE—HISTORY
EUROPEAN WAR
EVESHAM, BATTLE OF

[Anglo-French Relations. By Major-General T. F. Lloyd. *United Service Magazine,* Oct, '16. 3600 words.]

(Historical serial.)

[The Invasion Scare of 1803. By Katherine F. Doughty. *United Service Magazine,* Oct, '16. 3600 words.]

(Correspondence between the King of England and the Prince of Wales in 1803.)

[Anglo-French Relations. A Study: From the Death of Henry II., 1189, to the End of the Hundred Years' War, 1453. By Major-General T. F. Floyd. *United Service Magazine,* Jan, '17. 2800 words.]

(Continued, historical serial.)

[Anglo-French Relations. By Major-General T. F. Lloyd. *United Service Magazine,* Feb, '17. 2800 words.]

(Historical serial; from the death of Henry II, 1189, to the end of the Hundred Years' War, 1453.)

GREAT BRITAIN—Continued

[Anglo French Relations. By Major-General T. F. Lloyd. *United Service Magazine,* May, '17. 2000 words.]

(Continued; from the death of Henry II, 1189, to the end of the Hundred Years' War, 1453.)

[Some account of the British Operations Against the Carlists, 1836-1837. By Col. C. Field, R.M.S.I. (Rtd.). *Journal R. U. S. Institution,* May, '17. 7200 words.]

(This article is a detailed account of the operations of the Royal Marine Battalion against the Carlist forces and is of historical interest only.)

[Anglo-French Relations. From the Death of Henry II, 1189, to the End of the Hundred Years' War, 1453. By Major-General T. F. Lloyd. *United Service Magazine.* June, '17. 3200 words.]

(A historical serial.)

[The Royal African Corps, 1800-1821. By Major J. J. Crooks (retired). *United Service Magazine,* June, '17. 3200 words.]

(A short account of the services, etc., of the Royal African Corps.)

—Military Conditions in

See also

INDIA—MILITARY POLICY OF

PRESS CENSORSHIP

[Hukum Hai. Editorial. *The Army & Navy Gazette* (London), Sept 9, '16. 450 words.]

We understand that early this year the Army Council issued an "instruction" order intimating that at this time no officer was to publish under his own name, anonymously, or under quasi-concealment any article dealing with tactics or training.

This "instruction" has been reissued where all "soldier-writers" congregate. It thus appears that until the war ends we are debarred from reading the experiences of the man from "out there." The man who tells a true story can hardly help being instructive, thus conveying useful lessons, and there is where the Council's "instruction" apparently comes in. Nothing can be written by officers that may carry lessons of value and the many questions in regard to tactics and departures from ancient methods of training must be treated with the same aloofness which most of us have made up our minds to observe towards the Teuton when the war is over and he again desires to thrust his friendship upon us. Now that soldiers cannot give this information are we to look to civilian writers,—the crammer, and unemployed army tutor,—to deal with these special matters, or will the War Office do it? It is high time after two years of war that they did it if they propose to.

[The N. C. C. *Army and Navy Gazette,* Dec 23, '16. 300 words.]

Inhabitants of Lewes, who have accepted freely the provisions of the Billeting Act in the case of soldiers, have refused to house or trade with members of the Non-Combatant Corps, composed of a very limited proportion of cranks and an overwhelming proportion of physical cowards. These householders despise men who refuse to play their part in their country's great struggle.

—Military Policy of

See also

INDIA—MILITARY POLICY OF

[Recruiting in Ireland. Editorial. *The Army and Navy Gazette* (London), Oct 7, '16. 450 words.]

There has lately been much said about man-power and its relation to the duration of the war. In a letter appearing in *The Times* of Oct 4, Sir Edmond Carson makes it clear that in one portion of the Empire the government has made it impossible that our man-power can be developed to its full strength. He reminds us that when the Military Service Bill was before Parliament, he on two separate occasions moved to include Ireland in its provisions and on each occasion he was appealed to by the government not to carry the question to a division on the grounds of *expediency.* As a result of the Premier's appeal to Sir Edmond, we are told that it will be impossible to keep up the Irish divisions at the front, and that out of 650,000 men of military age in Ireland, not more than 120,000 have enlisted.

Compulsion was withheld from Ireland on the ground of *expediency;* what will be left of this middle class virtue when the Irish soldiers come home to find their places filled by the shirkers? Will the Irish leaders then find the *united* Ireland of which they are always talking? Surely Irishmen of all classes must and will realize that there is something even better than *expediency,* and that is *National Honor.*

[Two Notes On the War. My Major G. W. Redway. *United Service Magazine,* May, '17. 2000 words.]

The duration of the present war has brought into requisition means and appliances for registering facts such as the world never saw before: photographs, maps in which the plans of trenches are laid down as precisely as a municipal system of drainage, millions of descriptive letters and pocket diaries, so that no point of view will be missing.

It was the traditional luck of the British army to have to deal with an enemy under conditions that allowed them all the time they needed for preparation of both personnel and material; but even so their improvised army suffered unnecessarily from the spirit of daring; a feverish display of valor too often took the place of cool skill and calculated effort. The fact remains that only the solid infantry of 1914 could have stood up against the hordes of General von Kluck, and that an army composed of experimental companies would have ended the war two years ago by giving the Kaiser an absolute victory. But the tactical problem of to-day is entirely different, and fortunately it is one that suits the genius of the British people and the character of the Armies right down to the ground.

[Emigration and Ex-Service Men. By E. T. Scammell. *Army and Navy Gazette,* June 23, '17. 2000 words.]

(An article calling attention to the grave problems that will attend the close of the war, particularly in the re-absorption of the millions of soldiers in industry. The problem of inducing emigration to the colonies and settlement of lands is discussed. The service men may not care to do this and the sentiment expressed at a mass meeting of ex-soldiers and ex-sailors who had been wounded and invalided was one of derision at such a proposal. Such a sentiment is not so surprising, altho regrettable, from those who have been disabled.

There is, however, danger that the able bodied men returning from service may become the victims of land settlement private schemes. The government should take the steps necessary to prevent any such schemes from being carried out except under its approval and supervision.)

["The Air Defence of London." By F. W. Lanchester. *Land and Water,* July 12, '17. 3000 words.]

Of the various means of defence against raids such as those that London has experienced, that is to say raids on a small scale, that of direct defence by a screen of airplanes, or possibly concentric screens of airplanes, is the most extravagant and the least appropriate. If the attack be launched under weather conditions favorable to a raid, the enemy, flying screened by a stratum of clouds, may remain as invisible as a submarine totally submerged. To be effective, a direct defense founded on a screen of airplanes would require to be sufficiently strong at every point to meet a possible enemy; and a warning of at least half an hour would be required in order that the machines should be in the air at sufficient altitude to give battle. It is for this reason that nearly all the effective air fighting has so far been done during the return of the enemy to his base.

It would take perhaps five hundred airplanes to put up an adequate defence of London, and even then it is practically certain that the enemy under favorable weather conditions might slip thru. To immobilize five hundred machines for the defence of London against enemy raids of twenty or a dozen strong would be a far greater justification for the enemy to maintain and carry out a succession of such raids than the material damage which such a force has hitherto shown itself capable of effecting.

If to-day an attempt were made to bar the road to London by screens of airplanes, there would scarcely be a machine available in any of the fields of battle for the normal conduct of hostilities.

Those who call for reprisals should not forget that a diversion of aircraft from their military duties with the army in the field might justify the Germans in employing their machines where they know we are at a strategic disadvantage—in the raiding of London.

Those who have not made a study of the problem of air defence may ask why, if it pays the enemy to detach squadrons from fighting forces already inferior to our own in order to raid London, it should be bad policy for us to retaliate in the same coin. The answer is simple. London is within two hours easy flight of the territory in the occupation of the Germans; namely, Belgium. Berlin, the nerve center of Germany, is virtually out of range of our airmen. It is some four hundred miles distance from our nearest point of take-off. We are at a strategic disadvantage.

If the Germans can be got out of Belgium, the air defence of London is assured.

—Munitions—Manufacturing Facilities

See

MUNITIONS—MANUFACTURING FACILITIES OF—GREAT BRITAIN

—Navy

See also

EUROPEAN WAR—NAVAL POWER IN

[The Chief Command. By Arthur Pollen. *Land and Water,* Nov 9, '16. 3000 words.]

For the third time in the course of the war the paramount naval question of the moment is the character of the administration at Whitehall.

The first crisis occurred early in the war, beginning when *Goeben* and *Breslau* were allowed to get past the whole French fleet, a squadron of British battle cruisers and a squadron of British armored cruisers as well. Then came the lamentable naval episode at Antwerp. The situation culminated when after the German submarine successes in the North Sea, it was found that the Teutons were laying mines with impunity when and where they liked.

The adventure of the Dardanelles came as a rude reminder that there could be no guarantee against the continuance of disasters at sea until the conduct of naval war was taken out of lay, and put into professional hands.

The strength of the present régime has consisted chiefly in the fact that it has not been lay. The seamen on the War Staff have not been overridden and driven to mad adventures by their civilian chief. This is, of course, a negative merit. The positive achievement was keeping in far closer touch with the fleets, so that the Commander-in-Chief was able to exercise some influence on the general conduct of the war.

The weakness of the present régime has lain in the fact that its constituent members are entirely without war experience.

This war has been fruitful in surprises and rich in revelations of the unexpected power of weapons, and not less in proofs of deficient methods. The constitution of proper staffs for gunnery, torpedoes, mines and submarines to obviate the employment of fleets without reference to the limitations of their weapons, is a matter of the utmost urgency.

The failure to place the arts of using and of parrying the weapons with which naval war is waged under the care of an efficient staff is the most startling omission of the pre-war administration. It is almost unbelieveable that, with every naval weapon an untried novelty, there existed at the outbreak of the war no organization for the study of any one of them.

GREAT BRITAIN—Continued

[Sir Edward Carson On the Changes at the Admiralty. *Sphere*, Mar 10 '17. 500 words.]

In a statement before the House of Commons on the Naval estimate, Sir Edward Carson commented on the changes in the Admiralty. Admiral Sir John Jellicoe, twice one of the Sea Lords, once Director of Naval Ordnance, an expert in gunnery, and with unparalleled knowledge of the naval service, has been appointed First Sea Lord. Other experience is backed up by two and one-half years of war command. Admiral Sir David Beatty has been appointed Commander-in-Chief, thus at a very early age commanding the greatest fleet that ever sailed the seas. A fifth Sea Lord, to represent the Admiralty on the Air Board, has been appointed. It is believed that by the appointment of the Air Board and the co-ordination of its services and the supply by the Minister of Munitions, a great increase in efficiency will result, in addition to a great increase in the output of airplanes.

—Navy—Personnel

[Size of the British Navy Personnel. *Scientific American*, Mar 24, '17. 90 words.]

Some idea of the present size of the British Navy is afforded by the announcement in Parliament that 400,000 men were provided for in the financial estimates for 1918. Many thousands of these are manning the mine sweepers, submarine chasers, transports and supply boats, and still other thousands must be held in reserve.

GREECE

—History

See also

EUROPEAN WAR

[King Constantine's Dilemma and Some Historical Precedents. By Brig.-Gen. F. G. Stone, pcs., G.M., R.A. *Jour. Royal Artillery*, Dec, '16. 7000 words. (A lecture delivered at the R. A. Inst. on Thursday, Nov 23, 1916.)]

The present complex situation in Greece, changing in its external symptoms from day to day, would appear at first sight to be without a parallel in history; but a careful study of Greek and Prussian history reveals some startling precedents for the present state of affairs. A brief survey of Greek political history will help us to understand the present situation.

The Greek War of Independence, 1821-28, ended in freeing Greece from Turkish dominion. In 1829, Greece was declared an independent monarchy by the Treaty of Adrianople, and by the Convention of London (May 7, 1832) was declared an independent kingdom under the protection of Great Britain, France and Russia. Each of these powers was bound not to nominate a member of its own royal family to the Greek throne, and Prince Otto, son of Louis I of Bavaria, was proclaimed king by mutual agreement between the three powers.

Differences soon arose between the king and people owing to the despotic form of government introduced by Otto, which was opposed to the ideals of the people. Not only did Otto reign absolutely but he surrounded himself with Bavarian troops and counsellors. In 1843, a military revolt compelled the king to dismiss his Bavarian officers and accept a constitution. But King Otto never acquiesced in constitutional rule, and he became still more unpopular by his flagrant violations of the constitution. In 1862 another military revolt broke out and he was deposed by a national assembly. The vacant throne was offered to Duke Nicholas of Leucthenberg by the protecting powers, but the Greek nation desired a constitutional monarchy of the British type, and elected Prince Alfred of England. It was not possible to give effect to this election owing to the convention, and in the following year Prince William George, second son of the King of Denmark was elected under the title of King George I, King of the Hellenes. At the same time Great Britain ceded to Greece the seven Ionian Islands which since 1815 had formed a commonwealth under British protection. An ultra-democratic constitution was drawn up in 1864 and the king compelled to agree to it. This was the sixth since the establishment of the kingdom and remained in force until 1911.

In 1875, after an acute constitutional crisis, Charilass Trikoupis was summoned to form a cabinet. This remarkable man exercised an extraordinary influence over his countrymen for the next twenty years and next to Venizelos is the greatest statesman produced by Greece.

In 1897 the Crown Prince (present king) assumed command of the troops in Thessaly in the war against Turkey which ended in the complete defeat of Greece: his personality achieved for him some popularity in the army. The Turkish conditions of peace demanded cession of Thessaly and indemnity of £10,000,000. The opposition of Great Britain prevented cession of territory.

In 1901 an understanding was arrived at between Greece and Rumania to combat Bulgarian influence in Macedonia, but in 1905 there was a rupture of diplomatic relations arising out of the Sultan's official recognition of the Rumanian race in Macedonia.

In 1909 the "Military League" forced the resignation of the royal princes from their military commands. The "Military League" was dissolved in 1910 on the promise that a national assembly for the revision of the constitution should be convened, and in 1911 the new constitution came into force. The army was reorganized in 1912 and at the end of that year Greece joined the other Balkan states in the war against Turkey. The Crown Prince took command of the army in the field with considerable success which added to his personal prestige and popularity when in 1913 he succeeded to the throne as Constantine I.

From the brief sketch given, it is clear that Greek politics suffer from a normal condition of instability, but that a passionate democratic spirit is constantly in evidence.

A consideration of the history of the "Military League" and what it accomplished, with its dominant idea of a democratic constitution observed by all parties from the king downwards, reminds one of Crom-

well and the Council of Major-Generals, and will help us to avoid the error that the army is a king's army. It is the Nation in Arms and an extremely democratic nation at that. At the same time there is clear evidence that the German intrigue is not without effect in obtaining adherents in the army, and, while King Constantine controlled the army, for the present plot to involve the Venizelists in civil war in Macedonia to meet with success.

The departure of M. Venizelos for Crete, accompanied by Admiral Condouriotis, on Sept 25, marked the parting of the ways in the struggle between constitutionalists and the absolute government of the king. Before leaving, M. Venizelos made a clear and lucid statement of the situation to the *Times* correspondent at Athens.

Constantine's base repudiation of the treaty of alliance between Greece and Servia has scarcely a parallel in the history of any country except Prussia. Germany's attack on Belgium is a precedent in the present war; as Frederick the Great's treatment of his allies, France and Bavaria, in 1741, is a precedent of earlier date in the history of that kingdom. But Frederick, in throwing over France and Bavaria, and later Austria, did not actually abandon an ally to be utterly destroyed by traditional enemies as when Constantine threw over Servia. It has been stated that Greece ruined Servia, not alone by refusing aid, but by inducing M. Pashitch not to attack Bulgaria before she would have time to mobilize, by using the ingenious argument that if Servia were the aggressor, she would forfeit the right to help under the treaty. When Bulgaria did attack, Constantine refused to stand by the treaty. There also is said to exist a secret treaty between Greece and the Teutonic nations by which whenever certain conditions are fulfilled by Germany, Greece is to attack the Entente Allies, which makes the parallel between Constantine and Frederick the Great still more complete.

At the time we landed in Salonika, King Constantine, in appearance was in a similar strait to Frederick William III of Prussia in 1811 when the great struggle between France and Russia was impending. If Prussia joined France, it meant facilitating the operations of Napoleon's armies against Russia, and in the event of a Russian victory calling down the vengeance of the Czar who had saved Prussia at Tilsit. If Prussia joined Russia, which honor bade her do, what would be her fate if France were victorious?

If for Russia we read the Entente Powers and for Napoleon, Germany, we have the dilemma as it appeared. Frederick William signed a treaty with France. Has Constantine signed the treaty with Germany to which publicity has been given? After the defeated French army crossed the Nieman in its retreat, the Russian commander at Riga requested General Count von Yorck, commanding the Prussian garrison in Courland, to extend a benevolent neutrality to Russian troops passing thru that province in pursuit of the French. Yorck concluded a treaty with the Czar which, upon Napoleon's protest, Frederick William repudiated and placed Yorck in arrest. The next step was the setting up of a provisional government by Yorck and the great statesman Stein, and in the name of the Prussian nation the treaty of Kalisch was concluded with Russia.

The king remained irreconcilable for some days more, but finally bowed to the will of the people and declared war on France. Compare this with the action of Venizelos in raising an army to fight the Bulgarians.

The position is extraordinarily complicated altho M. Venizelos is optimistic as to the final outcome. The provisional government heads all its official documents "Kingdom of Greece" and is not aiming at the overthrow of the monarchy or the restriction of the crown's power, but simply at its definition.

If the crisis becomes serious for Constantine and his party owing to a national upheaval, will he play the last stake of a desperate despot, by accepting the intervention of Germany which assuredly will be offered, as Austria accepted the intervention of Russia in Hungary in 1848. The presence of the armies and fleets of the protecting powers has thus far restrained him, and it is only their continued presence and supremacy in the field that can save Greece from sharing the fate of Hungary in 1848.

GREGORIVITCH, General Michael

[The Black Flag in the Great War. By L. B. Ebdokimov. *Voenny Sbornik*, Dec, '16. 3000 words.]

(This article is a short and flattering biographical sketch, extolling the merits of Michael Gregorivitch, commonly known as the "Black General," the article being brought out partly in compliment to Serbia, of which country the hero of the account was a native, and partly due to the fact that the years 1915-1916 constitute the fiftieth anniversary of the participation of Michael Gregorivitch in the campaign of Central Asia.

Michael Gregorivitch was born in 1828, and soon entered the Russian military service. He served with much distinction in the campaigns of 1865-1866 in Russian Turkestan, and in the Turko-Serbian war of 1874-1876. Altho the article refers to many gallant exploits of the subject of the story, it does not describe them. Much poetry is quoted praising this national Serbian hero. He died in 1898.)

GRENADES

See also

TACTICS (Article: "Modern Battle Tactics")

[Hand-Grenade Squads in the English Army. Communicated by Col. Francisco Echagüe and Lieut.-Col. Juan Garcia Benitez. *La Guerra y Su Preparación*, Sept, '16. 600 words.]

The English were the first to take up the work of teaching the art of bomb-throwing. The personnel instructed by them was sent out to give instruction in various centers, one of which is Chalons, and from these centers instructors were sent to take charge of schools like that at Dommartin.

The students are lined up facing a number of parallel lines marked on the ground by small flags at distances of 20, 25, 30, etc., meters. They are then drilled

GRENADES—Continued

in throwing hand-grenades without charges. This exercise is executed with a swinging motion of the upper part of the body, the arms extended, the left hand pointing toward the target and the legs in the position of *guard*. The greatest distance which anyone has been able to throw the grenade in this exercise is between 45 and 50 meters.

After this exercise the men are practised individually in throwing at prone silhouettes, a screen being placed so that the thrower cannot see the targets but must make his shot from data furnished by an observer. After considerable drill in this exercise men attain to a speed of 35 grenades a minute.

The students next proceed to the drill in cleaning out a communicating trench. For this they are formed in single file in squads of eight, the base unit. In each of these squads the first two men (scouts) carry rifles with fixed bayonets. The third man is a bomb-thrower, the fourth an ammunition carrier, the fifth the leader of the squad, the sixth another bomb-thrower, the seventh an ammunition carrier and the last a soldier armed with a rifle with fixed bayonet. It this formation the squad advances thru the trench. When the scouts see an enemy, they call out, for example, "Five meters to the right, clean," and the grenade men throw their bombs accordingly. From time to time the leader calls out "Result!" and the scouts resume the advance to discover if the trench is cleared or what may be the new position of the enemy. If the leading grenade man is wounded, the leader causes the one in rear to advance to take his place.

The next exercise is a simulated attack of a trench. The squads are formed in column of files facing the trench. They are then pushed forward and caused to execute a "cleaning out" of the trench and the communicating trenches to the front as just described. It is assumed that the first line of the friendly infantry's attack has passed over the territory upon which the grenade squads are working.

Altho all the soldiers are expected to know how to throw grenades, fourteen men per company are specially instructed in the work.

In these exercises make-shift grenades consisting of cans filled with earth are used. They are provided with a detonator and are of the same weight as the service grenade, so that the method of using them may be the same as when actually working against an enemy. The soldiers themselves prepare these dummy bombs.

After the men have been thoroly drilled in these exercises, they are given practice at throwing service grenades. These are of three kinds: one of percussion fuse and two of time. The former is pear shaped and carries an exterior piece of the same shape, which covers one-half the grenade, and on being thrown, sets free a cord with a weight attached. This weight causes the part of the bomb containing the striker to hit the ground first, thus causing the explosion. The fuse of the timed bomb is ignited by a blow on the striker with the left hand. These bombs have the shape of an ellipsoid and in some cases have deep grooves to facilitate fragmentation.

The charge is of shedite. The danger zone extends to twenty meters on either side of the point of explosion in a trench, and on open ground the fragments may cause injuries at 250 meters. The handling of the bombs is somewhat dangerous on account of the sensitive character of the detonator. The explosion is so violent that the rush of air caused by it can be readily felt in a trench some twenty meters distant. The detonator alone is strong enough to explode the grenade without any interior charge.

[Grenades, Mortar Shells and Bombs. Editorial. *Army & Navy Jour.*, Sept 23, '16. 800 words.]

An Ordnance officer is developing a hand grenade the size of a baseball and designed to be armed by a special mechanism operated when the the grenade is thrown as a baseball is pitched. It is safe until so thrown, a feature missing in the grenades developed to date.

The War Department has definitely classified the various low velocity projectiles. The term "grenade" applies to hand grenades and the grenade thrown from a rifle by a ramrod attachment. "Trench mortar shells" are high explosive shells thrown from trench mortars, short portable guns limited to 800 yards range. An "aerial torpedo" is an explosive missile "capable of propelling itself thru the air by self-contained force." "'Drop bomb" is the term applied to explosive missiles intended for dropping from aircraft. They are classed as light-weight up to 15 lbs.; medium weight, 15 to 30 lbs.; and heavy above 30 lbs. Several special classes are mentioned, among them "return action" bombs. When these strike the earth a shell is thrown into the air. This shell is attached to a wire which causes explosion. It acts like a high explosive shell from a field-gun.

[Grenades. *Rivista di Artiglieria e Genio*, Jan, Feb, and Mar, '17. 65 words.]

The hand grenades used by the Austrians are spherical in shape. They have a diameter of about three inches, and weigh about three pounds. They can be thrown about 25 yards by hand and about 55 yards with the sling. The Burgsdorf grenade is used with the rifle. It has a range of about 310 yards and a danger area of about 40 yards by 10 yards.

["Marines Manual" Department. *Marines Magazine*, June, '17. 800 words.]

Grenades have been long in use. The latest type is one fired from a rifle. It weighs 1½ lbs. and results in 175 pieces in exploding. It has proper safety devices and is armed for detonation after traveling 15 yards from the muzzle. Fired at 10° elevation, the range is 140 yards. The butt of the rifle must be supported against recoil at low elevations. At elevations of 20° and above, the butt may be rested on the ground. At 40° elevation the range is 350 yards with 150 feet maximum height in flight. At 65°, the height is 225

feet and the range 150 yards. An isolated bush is a delusion as cover, since it attracts fire, but a mass of bushes prevents the enemy from seeing and aiming at individual soldiers. A tree is worse than no cover at all. A stone wall is poor protection on account of fragments, and besides offers a good target. Rocks too hard to splinter offer good protection, but a position with rocks behind forms a death trap.

It is dangerous to remain stationary in battle, because the enemy will get the range of a stationary target. In passing a crest in an attack, a volley from an enemy line behind the crest must be guarded against. The attackers should lie down at the crest until investigation is made.

Shells explode and throw earth and fragments upward. If a shell strikes near, it is best to lie down flat.

Strict obedience is necessary for concealment against aircraft. Soldiers must not look up, as faces are conspicuous. All bright parts of arms must be covered. Camps must be arranged so as to be inconspicuous from above. Irregular arrangement and concealment under trees are effective.

A new method of attacking Zeppelins is for an airplane to carry a bomb suspended by a wire. The bomb is lowered and the airplane flies across the Zeppelin. The motion of the airplane draws the wire across the Zeppelin envelope until the bomb comes in contact with it and explodes. The bomb and reel of wire weigh 25 lbs. Pilot balloons may also carry bombs which explode on contact.

—Grenadiers

[Platoons of Grenadiers of the English Army. *Revista Militar* (Portugal), Mar (?), '17.]

(A description of the methods of instruction employed in the English school of Grenadiers at Chalons. The methods are too well understood to require repetition.)

[Bomb Throwing. By Capt. Duran. *Memorial de Caballería,* May, '17. 2000 words.]

Bomb throwing requires certain practice and a special ability that all do not have; but when this is possessed, with a little industry, surprising results are attained.

During the last practical school of the 4th Regiment of Sappers and Miners, the writer was in charge of experiments with explosives, and also of the instruction of a group of grenaders. In forming platoons of grenadiers, men who had been shepherds and others adept at throwing stones were selected. After the first selection, an examination was given in throwing stones, and the most proficient individuals were finally taken for grenadiers. In this way four squads of six men each were formed, and a sergeant, also specially selected, put in charge.

A course was marked out, and instruction for distance throwing was first given. It is said that the French give a premium to the soldier who is able to throw a lanyard-grenade weighing 700 grams a distance of 72 meters. In this course, many were able to throw as far as 75 meters. The record throw in a favorable wind was 82 meters. After instruction in distance throwing was completed, throwing for precision was taken up. A trench 1.5 meters wide was dug, and the exercise consisted in throwing as many grenades as possible into the trench. Some soldiers could throw as many as five out of six grenades into the trench at a distance of 30 meters. The same men could put three grenades out of four into the trench at 40 meters. Bomb throwing should now be included in the instruction of a certain number of squads in all regiments, and in order to assume superiority over the enemy, practice should be had in the use of the various types of bomb throwing machines.

—Grenadiers—Instruction of

[Throwing of Hand-Grenades. Extract from "Addestramento della Fanteria al Combatimento." *La Guerra y Su Preparación,* March, '17. 975 words. 5 drawings. 6 photographs.]

The throwing of hand-grenades requires particular aptitude and dexterity, which may be easily acquired by a recruit without retarding his other instruction, as it may be considered as a gymnastic exercise or sport.

There are various kinds of hand-grenades: cylindrical, with or without handle; disk-shaped; spherical; ovoid. The weight never exceeds 1500 gms. The Aasen weighs 1100 gms.; the Sipe 700; the Excelsior Thevenot 1000.

The Aasen and the Excelsior may, for practice, be represented by a hollow iron cylinder with a wooden handle at one end, with a parachute of cloth attached to the handle by a cotton thread.

To throw the Aasen, the grenadier must first open the parachute, grasp the handle, and introduce the right hand inside the parachute; make a half turn to the right, advancing the left foot and planting it firmly on the ground; carry back the right hand until the arm is almost horizontal, hurling the grenade forward with full force, describing with the arm a semicircle upward. The grenade should be thrown a little before the arm again reaches the horizontal position.

To throw the Excelsior grenade a similar procedure is followed, bearing in mind that in order for this grenade to explode, it is necessary for the grenadier before beginning the movement to let go of the crosspiece. This grenade ought to be thrown very high.

A grenadier standing in a trench or behind a parapet generally does not have room for the necessary arm movement, and therefore must throw while lying on his side.

Lenticular grenades, and ovoid, cylindrical or spherical grenades without special appendages, can be thrown like a stone. If the grenadier is standing in a trench or lying behind an obstacle, he must have had much practice in order to throw the grenade the desired distance.

To secure good results, a grenade must fall not more than 12 meters from the target. A grenade can be thrown by hand about 30 meters. The grenade should fall almost perpendicularly. As soon as the grenade

GRENADES—Continued

is thrown, the grenadier must take shelter or at least drop to the ground in order to avoid the risk of being struck by fragments of his own grenade.

To train recruits in throwing grenades, the position of the target is fixed at about 15 meters at first, the distance being gradually increased. The exercises are at first executed on open ground, but if the grenades have no handle the recruits throw kneeling or prone. Finally the recruits are placed in trenches, behind parapets, etc. The exercises must be frequently in the most uncomfortable positions, as this will be the usual situation in war.

Before throwing the grenade, especially if the grenadier is behind a parapet, he must assure himself that there is no obstacle which will stop the grenade in its flight. It is a good rule to raise the right arm as much as possible in order to prevent the grenade from striking the parapet behind which the grenadier is sheltered. It is necessary besides to grasp the grenade firmly in the hand, in order to avoid throwing it backwards.

To train recruits, standing, to throw grenades with handles either forwards or to the left flank, the exercise must be begun on open ground and later carried on in a trench.

Grenadiers should also be trained in throwing simulated or empty grenades, or stones of equal weight by squads. The training should be completed by practice with loaded grenades. At the end of recruit instruction it will be possible to designate certain soldiers in each company as grenadiers for war service.

—Use of in European War

[Types of Metal Grenades and Grenade Guns. By B. Kaiserov. *Voenny Sbornik,* Dec, '16. 5000 words. Illustrated.]

A. GRENADES

Grenades, in all the armies in the present war, have substantially the same essential features, a detonator, a fuse burning from 5 to 5½ seconds, a bursting charge and its container. They will now be considered more in detail, by countries.

Austria

1. A hand grenade with time fuse, to be lit by the thrower before using. This type of grenade is objectionable, owing to the difficulty of lighting any kind of fuse during the excitement and turmoil of hand-to-hand fighting. In addition, the fuse of this grenade is liable to become extinguished, should it happen to fall in mud or in puddles of water. For these reasons the Austrians seldom use this grenade. This grenade is also slightly used by the Germans.

2. Similar to No. 1, but larger. [Note. The size of these grenades is not stated by the author, and his drawing has no scale shown.—Ed.]

3. A hand grenade with a parachute attachment, thrown by first whirling the grenade around the head. The parachute assures the grenade striking head on, causing a pin to strike a detonator, igniting a small charge of black powder which in turn explodes a larger charge of ecrasite.

4. A rifle grenade, being a shell case fitted with a percussion fuse, priming charge of black powder, and detonating charge of ecrasite, mounted on a long staff for firing from rifles.

5. The Aasin grenade, so named from its inventor, a Danish engineer. This grenade is in use in both the Austrian and German armies, and differs from those previously described in that bullets are imbedded in the bursting charge. Several sizes are made, varying from ½ to 1 kilo in weight. They may be thrown by hand or fired from rifles or from trench mortars. Ranges by hand are about 40 meters; from rifles, 300-400 meters; and from trench mortars, 400 meters. The number of bullets in each grenade is 72 for the smallest size, and 250 for the largest size. All bullets are 2½ grams in weight.

Germany

1. The "Shaba" grenade is a small hand grenade, exploding into many small pieces, and often used by the Germans to break up an attack made upon them. Its effect is more psychological than actual.

2. The "Head" grenade is a small hand grenade, charged with trinitrotoluol, detonator and fuse. The latter is a steel pin, actuated by a spring, which is normally kept from acting by a safety wire. When the latter is withdrawn, the pin moves forward and strikes the detonator, igniting a slow burning composition, taking five seconds to burn, at the end of which time the charge is exploded.

3. The "Cylinder" grenade is similar to, but larger than the grenade previously described. Instead of being spherical in shape, as in the "Head" grenade, it is cylindrical with a tube at one end, and contains about a kilo of trinitrotoluol.

4. The "Racket" grenade is a grenade mounted on a racket for throwing purposes. An exact description of its interior construction is not at hand.

5. A grenade similar to that described under par. 4, Austria.

6. The "Disc" grenade is another hand grenade so named from its shape. The metal elliptical discs enclose a bursting charge of trinitrotoluol, imbedded in which is a fuse of five seconds' burning length which is ignited before throwing. This style of grenade is suitable for ranges of 40-50 meters.

France

1. A spherical hand grenade, weighing 1.2 kilos in all, and fitted with a leather bracelet and cord for throwing. The bursting charge is 110 grams of melinite or black powder, exploded by a detonator. This in turn is ignited by a 5-second time fuze, the burning of which is started in same manner already described under No. 2 of Germany. This grenade is stated to be identical with that employed in the Crimean war by the Russian grenadiers. Its range is 20-30 meters.

2. A small hand racket grenade, consisting of a cylinder filled with melinite, and mounted on a wooden racket, for ease in throwing. A percussion fuse is used.

England

1. A grenade (Heil?), weighing about 700 grams, and made in two styles, one for hand use and the other for firing from a rifle. In the hand style, the grenade consists of a metal tube with a detonating arrangement at one end as already described above under No. 2, Germany. In the rifle style, a staff 25 centimeters in length is fitted to one end for inserting in the rifle barrel. In this kind of grenade the detonating arrangement is contained in a central tube, at the rear end of which is a striker normally held in place by a safety wire, which must be removed before firing. Upon firing, the striker is held by its inertia at the rear of the tube, but upon striking it is carried forward against a primer, which detonates the bursting charge. This projectile upon bursting gives about 20 fragments of 10 grams or over, and a large number of fragments of less size. A 2-gram charge of cordite gives a range of 200 meters, using an elevation of 30 degrees.

2. This is also a hand grenade, fitted with a rope tail for use in throwing, and also to better maintain the direction of flight.

Italy

Very little has come into print concerning the Italian grenades, but information has come to hand as to the following two kinds:

1. A rifle (staff) grenade with a central tube containing the usual striker and primer, and around which is packed the bursting charge.

2. A larger type of No. 1, but with a different firing device. In this grenade, the head is covered by a thin sheet metal plate, underneath which is a metal ball resting on, but not in, a central tube. Upon striking its objective this ball is forced into the tube, pushing before it a primer against a pin, which detonates the charge.

B. BOMBS, MINES AND TRENCH GUNS

In France, bombs are used of 1 to 16 kilos in weight, and mines of 58, 79 and 105 kilos weight. The smaller sizes of bombs are fired from small mortars of improvised patterns. The larger size of bombs are fired from old mortars of the time of Louis Philippe, and some new mortars now being manufactured in arsenals and of about 6-in. caliber. These mortars are fired at elevations varying from 45 degrees to 80 degrees, giving ranges up to 500 meters.

For firing mines, or torpedo shells, as these projectiles are often called, mountain guns of 80 mm. caliber are employed, as well as later-designed special trench guns. An old type of mountain gun of 58 mm. is also largely used, firing normally the 78-kilo mine, but capable of firing in addition both the larger and the smaller size. It would also appear from illustrated articles published in German periodicals that the French are now firing mines 4 meters long with a caliber of ½ meter.

In Germany and Austria various kinds of mines are employed, but in general it may be said that they all consist of a metal tube closed by wooden ends, with a central tube containing the detonating device, which is frequently a Bickford fuse. Such mines are fired from small trench mortars, which can be readily carried from place to place by two men, and having a range of some 300-400 meters. A somewhat larger type of mortar gives a range of 700 meters.

In addition to these small mortars, the Germans have special "bomb cannon" of about 2-in. caliber and about one meter in length, and still larger sizes up to 15-in. caliber, firing mines containing bursting charges of high explosives up to 70 lbs.

Little information is at hand as to trench mortars in use in the Italian armies. They appear from illustrations received to be very much of the same pattern as the French mortars.

GRENADIERS

See

GRENADES—GRENADIERS

GUNNERY

See

FIELD ARTILLERY—FIRE

GUNS

See

ARTILLERY (IN GENERAL)

GYMNASTICS, Military

See also

BAYONET—INSTRUCTION AND TRAINING

[Sport Reports. By A. Kolmin. *Voenny Sbornik*, June, '16. 3000 words.]

(This is an account of the records made at a Russian Olympiad held at Petrograd as a second annual event, giving the scores of competitors. The events included swimming, rifle firing at 300 meters range, revolver firing at 50 meters, usual jumps for height and breadth, and the customary running. The names of all winners are recorded.)

HANDLEY PAGE GIANT BIPLANE

[The Handley Page Giant Biplane. *Aviation*, May 15, '17. 973 words. Illustrated.]

Mr. Handley Page states that in this machine, Clifford B. Prodger, an American pilot, took up twenty passengers to a height of 7180 feet. Special efforts have been made at streamlining the nacelle. In the struts over the body, it is interesting to note how in large machines a more bridgelike type of construction creeps in, the two inclined struts being strengthened by a horizontal tie rod. The shock absorber is of the oil pneumatic type. The enormous body provides a totally enclosed space for the passengers. Consideration of the subject of airplane size raises the question as to whether or not there is a limit to their size, and therefore whether further progress in construction will be limited to improvements in present types or extended to the development of much larger types. No advantage would follow from an increase in size if it is accompanied by a disproportionate increase in weight which would more than offset constructional advantages, or if the large airplanes should have aerodynamical disadvantages. For larger bodies, the resistance will increase as the square of a linear dimension while the

HANDLEY PAGE GIANT BIPLANE—Continued

volume will increase as the cube. Consequently the body resistance per unit volume will decrease as the size increases. This decrease in resistance will have a cumulative effect in decreasing the weight of the remainder of the machine. From the pilot's standpoint, tho there has been less experience in flying larger machines, it may be safely said that by proper balancing of controlling surfaces the large machine can be built to fly as easily as the small one. Furthermore, there will be less work in flying the large machine since it will not be affected by wind gusts to the same extent as the small one.

HANGARS

—Design and Construction of

[Construction of Aeroplane Sheds in the Field. By Capt. G. C. Gowland, R. E. *Royal Engineers Journal*, Mar, '17. 600 words. One plate.]

(This is a short account of four airplane sheds erected in Egypt at a post 120 miles from rail-head. Each shed had to be 40 feet long with a clear span of 40 feet and walls 12 feet 6 inches high. Material had to be carried by camel convoy from rail-head, and no timber of suitable size could be obtained, so all members had to be built up. The scheme was proposed on Apr 6 and the sheds completed May 2, six days after the material was on the ground.)

—Floating

See also

AERONAUTICS—NAVAL USES OF (Article: "Aircraft Mother Ships.")

HARBORS AND ANCHORAGE

See also

PORTS

HELMETS

—Armored

[The Adrian Helmet Adopted by Our Allies. *L'Illustration*, Nov 25, '16. 175 words. Illustrations.]

The Adrian helmet has now been adopted in turn by the Belgians, Italians, Serbians and Russians. All of these are painted khaki, except the Rumanian which is gray blue. The manufacture of these steel helmets, begun in May, 1915, has not stopped for one moment since that date. It will soon reach its twelfth million, calling for the employment of 12,000 tons of steel.

[A Helmet for the Swiss Army. From the *Journal de Genève*. Furnished by Col. García Benítez. *La Guerra y Su Preparación*, Madrid, Jan, '17. 500 words.]

The Swiss Government, recognizing the necessity of issuing a suitable helmet to its army, has studied the question very carefully. The type now proposed for adoption and issue is of sheet steel, the outer surface being smooth all over. It has been shown that this will help in deflecting bullets. It will have a vizor with rectangular eye openings which, when not needed, folds up under the edge of the helmet. Under fire the vizor is dropped down and protects the forehead and eyes. The helmet will be nine-tenths of a millimeter thick.

[German Sniper's Helmet. *Scientific American*, Mar 17, '17. 100 words. Illustrated.]

A German sniper's helmet recently found in a captured German trench has its front half covered by Krupp armor plate a quarter of an inch thick for protection against direct rifle fire. The plate is attached to the helmet and held securely by straps.

HINDENBURG, Field Marshal von

[Hindenburg as Sailor. *Canadian Military Gazette*, May 22, '17. 400 words.]

It is now revealed that Field-Marshal Von Hindenburg is in supreme command of all the forces, by land and by sea, of the Central Powers. That fact explains the co-ordination existing between the activity on land and the activity by sea.

HIPPOLOGY

See

HORSES

HISTORY, Military

See also

AERONAUTICS—HISTORY
ENGINEERS—HISTORY

HONDAGUA, Port of (Philippines)

[Building a Front Door on the Philippines. By Monroe Woolley. *Scientific American*, Nov 11, '16. 1500 words. 2 illustrations.]

Nothing else we have done in the Philippine Islands is of greater interest to the American people, to our government, and to Pacific shipping interests than the completing of what is destined to become a metropolitan port on the east coast of Luzon. This port has had to wait for its construction upon the completion of rail communication between both shores of the island. It is situated at a place near Gumaca, called Hondagua, and is eight hours from Manila by rail. The new railroad taps thousands of acres of the richest lands in the islands. As a harbor, Hondagua is probably superior to any other in the islands. It has deep water everywhere, no obstacles, and the island of Alabat, lying across its entrance, land-locks and so protects it against the heavy swells of the Pacific.

The saving that this port will make in the Army Transport Service will reach thousands of dollars monthly.

HORSES

See also

ASSES
CAVALRY
MOTOR TRANSPORT
VETERINARY SERVICE

[Military Horse Racing. By Capt. Ferbel. *Memorial de Caballería*, June, '17. 3100 words.]

The preparation of a horse for racing includes long and methodical work, and an unlimited amount of

knowledge. There are no fixed rules, but there are certain principles that must be taken into account in the three parts that constitute the base of training, viz.: work, alimentation, and hygiene. Each of these parts has its own special importance, but is so intimately connected with the others that in order to get results none should be neglected. The first of the three is considered in this article. The work is divided into two periods. The first period should give the horse muscular strength and resistance. The second period should give increased lung power and speed.

The duration of the first period should be not less than two months.

(To be continued.)

[Military Horse Racing. By C. Febrel. *Memorial de Caballería,* Aug, '17. 1500 words.]

(Continuation.)

This article discusses in detail the various features of military riding and steeplechasing, position of the rider, seat, use of the aids, and the methods of training the mount. It does not permit of condensation.

(Continued.)

[Wastage of Horse Flesh. *Canadian Military Gazette,* Sept 11, '17. 300 words.]

Up to the end of last May, 250,000 horses and mules had died during the war, and about 30,000 had to be disposed of owing to age and disease.

—Breeding of

[Demarcation in Horse-Breeding. By A. de Q. *Memorial de Caballería,* Nov, '16. 4000 words.]

This article discusses the organization of stud and remount depots and breeding farms.

France has 22 stud depots which establish 720 stands. One stallion serves about 50 mares. The number of stallions at a depot varies from about 60 at the smaller depots to 400 at the largest. Germany had (some years ago) 18 depots, with a maximum and minimum of 409 and 100 animals respectively at each depot. Bavaria, Württemberg, Baden and certain other states were not included in the foregoing.

Austria has five depots with 16 sub-depots (data of 1903). The largest depot has 487 stallions, the other four depots 337, 322, 370 and 393 stallions respectively. Hungary has four depots, which include 18 sub-depots, with a total of 3023 stallions.

Russia has 24 stations where privately owned mares are served gratuitously. No station has fewer than 60 stallions.

Italy has seven depots (data of 1905), with from 70 to 80 stallions at each.

(Recommendations follow which refer to the organization, location and management of actual and proposed horse-breeding establishments in Spain.)

Austria

[Outlines for a Study of the Galician Breed of Horses and the Methods Most Appropriate for Its Improvement. By Capt. Manduit. *Memorial de Caballería,* Jan, '17. 2200 words.]

There are at least 100,000 mares in Galicia. The majority of these are used for the production of mules. Some 50,000 mules are exported annually.

For purposes of study, this strain may be classified in three divisions, viz.:

1. The horse of the coast.
2. The horse of the interior.
3. The horse of the frontier.

The coast horse is small, varying between about 12 and 14 hands in height, large headed, straight faced, low withered, short necked and large barrelled. The hoof is of such density that the horse can make journeys unshod. The color is generally chestnut. Mane and tail are heavy.

The horse of the interior is larger and always has *the mark*. The head and ears are large, the face narrow (sometimes sheep-faced), neck long but strong, withers regular, barrel large, croup oblique, hoofs compact, mane and tail heavy. This horse possesses exceptional ability to withstand work and fatigue.

The horse of the frontier has the characteristics of the horse of the interior and also of the adjacent localities. In some districts horses are found in a half-wild state and are captured only by being driven into corrals and lassoed. The flesh of these animals is particularly esteemed by *gourmets* of Paris and many are sold for this market.

The temperament of the Galician horse is lymphatic or oxlike and judicious crossing with foreign blood is necessary. State assistance to breeders and intelligent direction towards improvement of the strain would result in a few years in the production of an ample supply of horses for the army from this region alone. The advantage of being independent of foreign sources of supply is decidedly apparent at the present time.

[The Horse-raising and Remount Services in Austro-Hungary. By Major D. Pedro Obregón. *La Guerra y Su Preparación* March, '17. 2100 words.]

It is calculated that there are in the monarchy over four million horses, of which 600,000 are available for war. Depots of mares and of stallions are maintained by the civil administration, under military supervision. The object of the former is to raise good horses; of the latter, to supply good stallions for mares of private ownership. There are nine of the former in the monarchy and eleven of the latter. The mares in the former are of Anglo-Arabian, English, half-English, Spanish-Oriental, or Spanish-Neapolitan blood.

The inspection and direction of the remount service in time of peace in the Common Army is under an inspector general of remounts and a section of the Common Ministry of War; in the Austrian Army under the inspector of Cavalry and the Austrian Ministry of War; in the Hungarian Army under the inspector of Cavalry and the Hungarian Ministry of War. Horses are generally purchased in autumn; colts, in the spring. Artillery horses cost 950 to 1200 crowns; others 800 crowns; pack animals 500 to 600 crowns. Saddle horses give an average of eight years' service; draft horses, ten. The total number needed for the three armies annually is 14,000. 40 per cent of the horses are purchased from the stock-farmers, the remainder are purchased from dealers, in fairs, etc.

HORSES—Continued

Each horse is branded in three places, the mark on the rump being the initial letter of the arm of the service and the number of the regiment.

There are six depots of colts which furnish 20 per cent of the horses. The object is to furnish the army with horses better nourished and trained than those which are bought full grown, and at less expense.

Condemned horses are branded with the imperial crown inverted under the mane. Some are used in the train, others for mounted detachments of dismounted organizations, others are sold at auction.

In time of peace 30,000 horses which have rendered service are loaned to private persons; in case of mobilization they must be returned to their regiment in 24 hours. Each year they must also assemble for maneuvers for a few weeks. A loaned horse becomes the property of the borrower after a number of years which depends on the condition in which the horse is kept. The object is to form a reserve of saddle horses.

The state furnishes a horse to each captain and subaltern of cavalry, artillery, or trains, to each adjutant of infantry or fortress or coast artillery and to each chief of a machine gun section. The horse becomes the property of the officer after eight years. In addition certain mounted officers are required to have one or more private horses, receiving a single payment from the state for the purchase. Each such horse receives forage, stable accommodations, shoes and medicine, from the state. In time of war the state furnishes mounts to officers of the quartermaster service and to subalterns of technical, sanitary, and veterinary troops.

Spain

[Horse Breeding. The Production of Arabian Horses in Spain. By Breeder. *Memorial de Caballería.*, Dec, '16. 2100 words.]

The following remarks upon the transformations undergone by Arabian horses in Spain in the attempt to produce a pure blooded race for military use are based upon four years of careful observation of the results obtained at the breeding depot at Jerez de la Frontera. At this depot, the General Direction of the Horse Breeding and Remount Establishment are trying to get pure blooded individuals.

Two classes of stallions are used, the one brought directly from Arabia, the other from France, England, and Russia. Nearly all of the European stallions are from Russia. These are larger than the original Arabians, but in temperament are generally inferior. The colts obtained at the depot are better than their progenitors. The excellent methods pursued are doubtless responsible for this. The original Arabian stallions are smaller, more energetic in temperament, with distinguished lines, but in comparison with the Russians, less robust and less strong in the legs. Not all are defective, but unfortunately the depot does not possess a single original Arabian stallion of exceptionally high class. This is because the purchase of animals in Turkey was delayed until after the market had been picked over by foreign buyers. Also because perfect Arabians are—and always have been—very rare.

The stallions imported from Russia are excellent. One of them (named *Van-Dick*) is unusual in that he unites the fine qualities of the Arabian with good height (1.63 m.), great strength and correct proportions. It would be difficult to find in all Europe another horse so perfect. As a reproductor, however, *Van-Dick* is lacking in prepotency, tho his progeny are unusually good types.

There are three groups of mares at the depot, viz.: those purchased in Arabia, those purchased in Russia, and those bred at the depot from the above two groups. The characteristics of the last group will be discussed in a following article.

(To be continued.)

[Horse Breeding. The Production of Arabian Horses in Spain. By Breeder. *Memorial de Caballería*, Feb, '17. 2400 words. (Conclusion.)]

(The preceding chapter was devoted mainly to a description of the stallions and mares used in the attempt to secure a pure Arabian strain. This chapter discusses the results attained. Hopes are entertained that an Arab type superior to the best now to be found in Europe will be produced.)

[Horse-breeding. By Major Azpeitia de Mores. *Memorial de Caballería,* March, '17. 2200 words.]

The Department of Horse-breeding, organized in 1904, has attempted from the beginning to import the best types of horses and mares with which to improve the race in Spain. Purchasing boards in successive years have brought in the finest animals obtainable in France, Asiatic Turkey, Russia, and England, and the progeny of these have been distributed thruout the Peninsula. Frequent changes in the higher command have interfered seriously with this important work. Spain is not now a horse-producing country. It is with difficulty that enough horses are found to meet the needs of the army and it is necessary to import horses for draft purposes as well as for pleasure and sport.

In European countries, except England and Spain, horse-breeding is regulated by the government. Spain has the elements for producing perfect types, but lacks adequate organization

The solution of the question of production lies in the passage of proper laws for the regulation of breeding.

Swizerland

[Organization, Mobilization and Remount Service. Anonymous. *Schweiz. Zeit. f. Art. u. Genie.* Jan, Feb, Mar, '16. 10,000 words.]

The problem of remount supply of a nation is intimately connected with the plans of organization and mobilization. After the war of 1870-71 an effort was made to reduce the number of horses required, by changes in organization and by mounting individuals only where absolutely necessary. New requirements and new organizations made it necessary in the course of time again to increase the number of horses. A census was therefore taken at fixed periods to determine the number and the suitability of the horses in the country. The conclusion drawn therefrom was that the horse supply was adequate for the require-

ments of any war. But the experiences of the recent mobilization have shown a glaring deficiency in suitable animals, in spite of the fact that improvements in mechanical traction have made more horses available for military service than ever before.

Three reasons may be proposed for this deficiency: 1st. Inability correctly to estimate the requirements, or failure to curtail requirements to the irreducible minimum. 2d. Carelessness in examining and registering horses for suitability by the census commission. 3d. Failure of organization commanders to appreciate the necessity of gradually accustoming animals just taken from industrial and agricultural pursuits to the rigors of military service. By far the greatest damage was caused in this way. Whenever untrained horses have been suddenly called into active service, the losses have been enormous. Furthermore, our officers had also failed to appreciate the changed conditions of modern warfare. Instead of gradually accustoming their draft horses to long trot periods and training green horses to work as a team, battery commanders at once began work by going into action at a gallop.

Two lessons may be drawn. In the first place we must suit the conditions of peace to the requirements of war. Horses with defects that manifest themselves under intensive work should not be considered. But far more important is the need of educating our officers and men to carry out a rational system of systematic training.

At present Switzerland is cut off from all outside sources to meet its deficiencies in saddle, draft and pack animals. Due to the mountainous character of our country, and the organization of new units requiring pack animals, our greatest deficiency is in pack and draft mules. Because of his surefootedness, his hardiness, his ability to live on all kinds of forage and under all conditions of weather, and above all the ability to care for himself in spite of neglect, the mule is far superior to the horse for mounted warfare.

Our horse breeding also needs to be systematized. In former years the breeding industry was very prosperous and successful. It has never recovered from the French invasion of Napoleonic times. All our breeding stock was then requisitioned by the French. An attempt was made later to refresh our native breeds by imported Belgian and half-bred stallions. In doing so too much attention was paid to exterior form and lines and not enough to quality and pedigree. As a result our native types have been obliterated. Due to indiscriminate crossing they fail to breed true to type. The government must soon take charge of the breeding industry in the military and industrial interests of the country. This is the only way in which we can become independent of foreign sources. To promote and develop the native breeding industry in horses and mules it will be necessary 1st. Carefully to select all stallions and brood mares; 2d. To supervise the use of all animals used for breeding; 3d. To subsidize this industry or to promote it by offering inducements.

—Equipment—Saddles

See
Saddles

—For Artillery—Qualifications of

[Horses for the Service of the Spanish Artillery. By Capt. Cayetano de Cabanyes, Spanish Artillery. *Memorial de Artilleria*, Madrid, Aug, '16. 8500 words. Figures.]

The rapid advancement of motor traction has served only to make the horse economically more important, and he is still a necessary element of our civilization both in peace and in war. Each separate country should be able to furnish its own supply of horses lest, at the outbreak of war, it find itself at the mercy of some uncertain foreign supply. The typical Spanish horse is better fitted for the saddle than for draft, and the question of artillery horses is, therefore, a very important one; hence an effort is being made to prepare the breeder to produce such horses.

According to the duties they perform, artillery horses may be grouped as follows:

1. Draft horses for field artillery regiments and for mounted troops.
2. Draft horses for mounted regiments and for mounted officers and troops.
3. Saddle horses for officers of field artillery regiments.
4. Saddle horses for officers and troops of mountain and heavy artillery.

First Group

This is the most important group and these horses must be able (three pairs) to pull the guns over varied ground at a fast walk and trot, the weight being as follows:

Limber, piece, cannoneers, etc., 4295 pounds.
Limber, caisson, cannoneers, etc., 4576 pounds.

The average daily march for this class of artillery will vary from eighteen to twenty-two miles; an exceptional march, from forty-five to fifty miles, the maximum limit of a day of forced marching by well trained and seasoned infantry. The Spanish regulations fix the rate of march at 5 2/5 miles per hour, the French at not over 5 miles per hour for marches, but at any time good artillery must be able to make 7½ miles per hour over varied ground. The nature of the ground must not affect the ability of the artillery to march, and a maximum slope of fourteen per cent. is admitted. It is seen, therefore, that these horses must possess unusual qualifications.

The weight of the horse is the first important factor. Perhaps the total work developed by a heavy horse is much less, relatively, than that of a smaller animal, but the useful work is, of course, actually much greater.

Discussing the normal tractive power of horses Colonel Federico Grund, Spanish Artillery, has established the following equation

$$R = \frac{hn}{OO'} \times P$$

in which the second member represents the force necessary to overcome R, the resistance which the carriage offers to motion, P is the weight of the animal applied

HORSES—Continued

to the center of gravity O, OO' the horizontal displacement of the center of gravity and hn the maximum ordinate of its curvilinear motion. From the equation it is evident that the resistance to motion (equal to the force necessary to overcome it, which force we shall call E) is directly proportional to the weight of the animal. At the ordinary gait we have, approximately:

$$OO'=0.80\ m.$$
$$hn=0.12\ m.$$
$$\text{or } E = \frac{12}{80} x\ P.$$

Substituting different values for P:

$$P = 880\ lbs;\ E = 135\ lbs.$$
$$P' = 1100\ lbs;\ E' = 168\ lbs.$$
$$P'' = 1320\ lbs;\ E'' = 204\ lbs.$$

Adding to these values of E the additional force each horse can exert by lowering his head, which, according to Marchart, is 2.66% of his weight, we obtain

$$E = 158\ lbs.$$
$$E' = 197\ lbs.$$
$$E'' = 238\ lbs.$$

These values prove conclusively the superiority of the heavier animal, for comparing E and E'' we see that

$$E:E''\ ::\ 2:3$$

One of the greatest advantages of the heavy horse, appears in working down hill. There is, however, a limit in weight, height and age in this class of animals: in weight from 1000 to 1300 pounds, in height from 14.3 to 15.3 hands and in age 4 to 7 years.

These conditions fix definite limits, outside of which, a horse cannot be considered as belonging to the first group.

Second Group

These troops are supposed to follow up, and fight with the artillery and therefore both of these arms must possess the same degree of mobility. For that reason horses of the second group should include the same general characteristics as those described for the first and in addition should be able to maneuver at the gallop. The hunter type combines satisfactorily all of the required conditions.

Third Group

In discussing this group, it must be remembered that officers have to leave their posts at unusual times and for unusual and unexpected purposes. These horses should therefore be able to maintain an extended gallop. This ability is highly desirable in a soldier's horse, and necessary in an officer's. In general the conditions demanded by this group are: horses or mares from 4 to 7 years, with galloping ability, a height of from 15.2 to 16.1 hands, and the normal conformation of a good saddle horse.

Fourth Group

The necessary qualifications for this group are the same as those for the third with a concession of an inch and a half in the minimum height.

—For Calvary—Choice of Breeds

[Horse Talk. By Augustin de Quinto. *Memorial de Caballería*, Feb, '17. 3200 words.]

(A disquisition upon the type of horse necessary for the cavalry, and upon methods for producing this type.)

—For Cavalry—Qualities of

[Experiments with "Reduced" or "Minimum" Type of Horses. By Capt. Frank L. Case, U. S. Cav. *Jour. U. S. Cav. Assn.*, Jan, '17. 1800 words.]

A new condition was introduced by the movement of the National Guard organizations to the Mexican border, requiring the purchase of 77,000 horses and mules. There was doubt as to the supply on account of heavy foreign shipments. Frequent informal reports indicated that a large number of excellent horses could be secured if the specifications were slightly reduced as to height. It was believed that a suitable horse of 14.2 type could be secured where there would be a scarcity of specification animals.

On May 9, 1916, the Quartermaster-General authorized the purchase of horses of minimum height 15-1 for artillery and 14-2 for cavalry, otherwise to conform to approved specifications. Similar authorization was made concerning purchase of horses for militia organizations. No difficulty was found in purchasing over 1200 horses at $110 for cavalry and $129 for artillery horses. Experience showed that there were many of these small type horses available in Texas and that larger horses could not be secured in numbers on a hurried call.

On June 10 advertisement was made for about 25,000 cavalry horses, 16,000 artillery horses, and a total of 20,000 mules of all classes, to conform to approved specifications, with alternate bids for artillery horses of minimum height 15-1 and cavalry horses 14-2.

Contracts were let for approximately the above numbers of the reduced specification type. The price jumped to $125 and $145 for cavalry horses, even as high as $179 on some small contracts. As high as $195 was paid for artillery horses. The large numbers called for made it necessary to pay about what was asked, and the price of specification type would have been much higher. The experience proved that there were plenty of these smaller horses available.

Reports were called for to ascertain how satisfactory the reduced type had proven. In fifteen cavalry reports, nine stated that the reduced type performed the work best, and on the general question of suitability of the two types, opinion was equally divided. Artillery reports were less favorable to the reduced type, only six officers of twenty-three reporting in favor of this type. [Various special reports are then quoted and the following general conclusion reached:]

"First, the smaller cavalry horse has given much better satisfaction than the artillery horse of the reduced type; second, to secure the best work, the reduced type of cavalry horse should have greater weight in proportion to height than the specification horse; third, the smaller type of artillery horse is fit only for

lead teams; fourth, in purchasing artillery horses of the minimum type, stress must be laid on securing an agile animal of compact and stocky build."

[The Type of Cavalry Horse for Campaign. By Capt. Clarence Lininger, Cavalry. *Jour. U. S. Cavalry Assn.*, Apr, '17. 2000 words. 2 tables.]

(As a result of study of the types which answered best the hard work in the field operations in Mexico, the author concludes that the best horses were young in years, young in service, long of leg, deep of body, tall at the withers, short of body, and greater in girth. The best type is the "square" horse. He must possess good teeth, good digestion, excellent power of assimilation, an omnivorous appetite, soundness, size, and strength, legs long enough to maintain regulation gaits, and beautiful proportions.)

—For Cavalry—Training of

[Considerations About the Gallop. By Major Fermosa. *Memorial de Caballería*, Nov, '16. 3000 words.]

The new regulations prescribe the extended gallop over considerable distances in tactical evolutions, especially in the deployment of the larger units. Extensive use of the gallop without proper preparation of the mounts is exceedingly dangerous, and it is to be lamented that the Military Equitation Regulations devote only twenty-three lines to the study of this gait.

The faculty of a horse for galloping depends upon his origin or race, his special conformation, his age and condition and upon a methodical and progressive system of preparation. Preparation of a horse for galloping should begin at an early age before the development of the animal is completed.

Colts bought at the age of one year should be given light and easy work in liberty at the walk and trot. In the second year the gallop should be employed moderately, in combination with the other gaits and with jumping, the colts being at liberty in circular corrals. During the third year the colts should be worked more freely with reference to the gallop, but a speed of 500 meters a minute and a distance at the gallop of one kilometer daily should never be exceeded. At the end of the third year of training, the horses would surely have greater capabilities for galloping than they now have under the present system. The gallop is the gait most fatiguing to the horse. It should not be used with a rider until the horse, by a series of gymnastics lasting for two or three months, has been given ease of movement, flexibility, force, and equilibrium under the weight of the rider and equipment. The horse should also have benefited from the grain that is given upon arrival at the regiment.

(Suggestions follow for a progressive course of training, the daily exercises last for a period of one year, after which the horses are galloped once or twice a week to keep them in training.)

[Considerations About the Gallop. By Major Fermaso. *Memorial de Caballería*, Dec, '16. 2800 words. (Conclusion.)]

Many persons may regard as unnecessary the system of preparatory exercises recommended in a preceding article. Development of the lungs is the most important end sought.

The principal defects of remounts are that they have too spirited a carriage and too short a stride at the gallop. Commanders should insist upon special exercises for the elimination of these defects. It is inadvisable to attempt correction with the horses at drill. They are then weighted down with the rider and equipment, pressed in on both sides by adjoining files, more or less excited by the action of the bit and breathing an atmosphere of dust. The system outlined increases the lung power, lengthens the pace, gives a free carriage—in short develops the young horse properly for collective work in ranks. In collective instruction of both men and horses the gallop should be used with great caution. A general principle should be that gallops be made short and separated by intervals of marching at a walk and trot. Three gallops of four kilometers each separated by rest intervals of 15 minutes each cause great fatigue, altho 12 kilometers only are covered. The same or a greater distance, if made in gallops of two kilometers, each separated by about four minutes of marching at a walk, can be traveled with much less fatigue and in less time.

The commander should watch the weaker and slower horses, as these are the first to show fatigue. He should remember that after violent exercise the respiration becomes normal before the heat does. The temperature, elevation, terrain, condition of horses, etc., should always be taken into consideration when using the gallop.

—Purchase of

[A Method of Purchasing, Inspecting and Handling Horses for Government Service. By Maj. C. E. Hawkins, Q. M. Corps (Cavalry.) *Jour. U. S. Cav. Association*, Jan, '17. 10,000 words.]

The smallest board that can properly and efficiently inspect horses or mules consists of one inspecting officer, one veterinarian, one clerk, and one messenger. Such a board can inspect and ship about 75 animals per day. The operations are inspection and weighing, test under saddle or in harness, checking, branding, diagram description, and shipment.

A *double board*, one inspecting officer, one Q. M. agent, two veterinarians, three clerks, and one messenger, is suitable for rapid and efficient inspection and can handle 150 to 250 animals per day five days per week. The maximum of 250 can only be reached under the best circumstances with good animals. A double board may be split into a primary board and an auxiliary board, the latter doing the preliminary and the former the final inspection, which can only be done by an officer.

The inspector should have both theoretical and practical knowledge of horses and mules. He should be of long service with mounted troops, a graduate of the Mounted Service School, and have good knowledge of type, conformation, age, defects, and soundness.

A board of several officers gives divided responsibility and produces unsatisfactory results.

HORSES—Continued

The inspecting officer controls the organization and assigns the duties of the board, makes final judgment of the animal, and takes charge of the records.

The floor veterinarian assists the inspecting officer by advising with respect to type, conformation, soundness and age. He also has charge of the stables, corrals, cars, etc., for the horses and of vaccination against shipping fever, mallein test, etc.

The floor clerk keeps complete records of the animals inspected. The messenger weighs the animals, and records their weight, and attaches the number assigned by the floor clerk on a linen shipping tag and fastens it securely to the mane of a horse or tail of a mule by a fine wire.

The Q. M. agent should be trustworthy and an experienced practical horseman. He supervises the tests under saddle or in harness, which include the test for wind. Pack mules are usually tested for wind by being driven back and forth at a fast gallop in a runway. Few small type animals are of unsound wind, but a much greater proportion of the heavier, and especially heavy draft types.

The second veterinarian works with the Q. M. agent in his tests.

The second clerk works at the place of branding and prepares complete descriptions of animals. The third clerk has immediate charge of branding, and is also shipping clerk. He checks the animals at the end of each day's work, and when finally loaded in the cars. He procures attendants and keeps records pertaining to the contracts.

Adverising for animals.—Advertisement must have authority of Q. M. General. Advertisements are placed in principal papers in zone of purchase, and if immediate delivery is required, proposals should be mailed to breeders and dealers.

Information to prospective bidders is mailed with each proposal. Bids are opened at a specified time in presence of bidders. Record and abstract of bids are prepared, and recommendation sent to Q. M. General. Contracts on standard forms are entered into with the successful bidder.

Assembling animals for inspection.—Under the contract system, the contractor usually assembles the animals at a point chosen by himself, where he cares for them until the date of inspection. Our own and foreign buyers find it necessary to go to the large markets to procure great numbers of animals. This introduces danger of infection, but the same danger will always exist where large numbers of animals are assembled. Purchases by boards traveling about do not achieve satisfactory results.

Method of inspection.—A proper place for inspection is necessary. A level space, preferably board or concrete floor, for measurement, good light for examination of eyes, and a suitable place for walking or trotting the animal before the inspector are required. (Here follow full details of the making of the examinations and tests for conformation, age, etc. A flash light is used with good results to examine the eyes on dark days.)

Records made at inspection.—The floor clerk should have a small pad about 4x10 inches. The name of the contractor, date, place, and class of animals are recorded, and a complete record of each animal is entered. At the branding point the diagram clerk makes his record of markings. It is a mistake to try to make out the regular descriptive cards at this point, because there is not time to do it properly, the cards get badly soiled in inclement weather, it leaves the inspector no record unless a duplicate card is made, and the comparison of the floor clerk and diagram clerk's records gives a good check on each other's work.

(The method of branding is described in detail.)

After animals are accepted and branded, they should be shipped to destination as soon as possible. If necessary to keep the animals a few days, the contractor usually cares for them at the expense of the United States.

(The author recommends against vaccination and inoculation. Care and sanitation and quick shipment with quarantine for two weeks after arrival at destination are recommended.)

Loading.—Animals are usually loaded thru chutes or from platforms. A 36-foot car will hold 20 regulation artillery or 22 cavalry horses. A 40-foot car 22 and 25 of the respective kinds. The Arms Palace car is a stall car for 18 animals, stalls crosswise. These cars permit feeding and watering en route and journeys of three to five days can be made without unloading. If shipped in common stock cars, stops for feed and water should be made every 28 to 36 hours. The law requires unloading for feed, water, and rest at these intervals.

Attendants.—One attendant can care for a maximum of four common stock cars or two Arms Palace cars. The attendant should have blank feed order receipts, form for receipt for animals at destination, and a list of animals showing class and hoof number.

Contracts should be let only to reliable and trustworthy contractors. Low bids mean poor horses or unfulfilled contracts. Many deceptions are attempted by contractors, such as having the teeth of animals "doctored" to deceive as to age, blowing up sweenyed shoulders, doping to conceal heaves, covering or filling toe and quarter cracks, trimming hair over splints, spavins, etc., causing fresh injury to conceal old defect, substitution of one animal for another, false measuring standards, and many other schemes. All these must be guarded against in the inspections.

It is impossible to secure adequate inspection by an inexperienced board. A Department of Inspection and Purchase of Animals should be created at the Mounted Service Schools, for the purpose of giving instruction for this work. From among officers taking the course, the best could be selected for inspectors.

The Remount Service and Remount Depots should have a head subject only to the orders of the Q. M. General. He should direct and co-ordinate the work of the entire Remount Service and should have the best veterinarian in the service as his assistant.

The farming operations at Remount Depots should be placed in the hands of a graduate farmer from an agricultural school, relieving the inspecting and purchasing officers of the supervision of this work.

[A Method of Purchasing Horses. By the Fort Reno Remount Office. *Jour. U. S Cavalry Assn.*, Apr. '17. 7000 words. Diagrams and tables.]

(This article comments on the system of purchasing described by Major C. E. Hawkins, of which the defects noted are that the method pays too much attention to paper work at the expense of inspection. The defects pointed out are the contemplated preparation by the inspecting board of the descriptive list, the use of the hoof brand, the use of a combination of letters and figures as a hoof brand, the use of a board of eight members to accept and ship 150 to 250 animals per day, the use of public stock yards for inspections, the abandonment of the idea of controlling the feeding and care of animals prior to inspection, and failure to safeguard against fraud by substitution of animals.

The scheme proposed contemplates inspection at government controlled yards, abolishing the present descriptive list as a function of the inspecting officer, replacing the hoof brand by a body brand, an inspecting board of not more than three members plus branders, and insistence on supervision of feeding and care of animals prior to inspection. The details of the proposed scheme of inspection and purchase are given.)

—Remount Depots

[Switzerland. State Remount Depot for the Army. *Revista Militar*, Aug, '16. 380 words.]

Congress voted 536,000 crowns last June for the establishment of a remount station at the government farm of Ottenby. This is the first establishment of the kind in the country. The object is to produce thorobred horses for the army.

—Stables and Tentage

[Peat or Straw Bedding for Our Service Horses. By Lieut. W. Künzli, Swiss Artillery. *Schweiz Zeit. f. Art. u. Genie*, April, '16. 2000 words.]

Experiments made with peat as bedding for stalls have shown its superiority over straw bedding, due principally to its affinity for ammonia formed by the urine. The amount of ammonia gas in a stable bedded down with peat and not changed for a week was about equal to that generated in straw bedding in a single day.

The peat is bedded down as a thick mattress about 15 to 20 cm. deep, a board across the rear end of the stall holding it in place. About once a week only the small area in the center upon which the animal is constantly stalling need be renewed. A mixture of peat and straw is not recommended.

—Training of

See also

EQUITATION

HORSES—FOR CAVALRY—TRAINING OF

HOSPITALS

[Plans for New Army Hospitals. *Modern Hospital*. Sept, '17. 500 words.]

The army medical department will spend $14,500,000 in the erection of thirty-two army hospitals. Provision will be made in the United States for 5 per cent of the enlisted strength by early fall, to be extended later to 10 per cent. In Europe, accommodation for 20 per cent of the strength of any expeditionary force will be provided. At the cantonments, provision will be made for 3 per cent of the troops. The standard is a 1000-bed hospital, costing complete with heating apparatus about $500,000, and covering about 60 acres.

The equipment will be of the best, but the buildings will be of cheaper construction, each 24' x 157', with capacity for 32 beds. A 1000-bed hospital will require about 70 buildings.

Each hospital will have laboratory facilities. There will also be an infirmary for each regiment for the treatment of light cases.

There will be nearly 1,000,000 men in service exclusive of the regular army. Some of the training camp hospitals will be enlarged, and two general hospitals at ports are being taken over. Two other hospitals are being enlarged, and a number of general hospitals are being provided by construction or enlargement for special treatment work. Plans for this phase of the work are not complete. Later plans will include reconstruction hospitals for artificial limb work, repair surgery, and re-education of cripples.

Each man in the new army will have six or more examinations by specialists, in addition to the regular examinations.

—In European War

[First Aid and Dressing Stations in Battle in the Austro-Hungarian Army. By Lt.-Col. J. H. Ford, M.C., U.S.A. *The Military Surgeon*, Aug, '17. 2600 words. 17 illustrations.]

The one danger which first aid stations sought to avoid was direct rifle fire. In order to obtain security with proximity to the front, those serving infantry were situated either in the trenches, in a support trench, or when the ground allowed, at some point near the line, but invisible to the enemy and accessible from the front by trench or some irregularity. If the terrain was very flat, the station was often in a trench just behind the line. If the exits were not protected, the wounded often remained in the trenches until nightfall. In other cases, the first aid station was opened in a building 500 yards or more behind the line. Wounded lying between the lines were recovered, if possible, after nightfall, but this was not always possible, because of the illumination of this zone, or of the nearness of the enemy trenches. The wounded that could not be recovered often died of starvation, thirst, or from exposure.

In the first aid stations visited, no surgical work was attempted, except twice when ligatures were applied. The patient's wound was usually found dressed with his own first aid packet, and if this was well done, the dressing was not renewed. If poorly done, or if opportunity served, the first aid bandage would be removed, iodine applied, the wound redressed and, if required, splints put on. Morphia was freely used to relieve pain. First aid stations were cleared by

HOSPITALS—Continued

native wagons packed with straw. All the wounded were removed whether classified as untransportable or not. If untransportable they remained in the dressing station.

As the war progressed stations sought greater protection than they did at first. Dressings well applied were not removed at the dressing stations. More serious cases were dressed over again, if time allowed; iodine was applied to all cases. If clothing was found in the wound, 500 c.c. of tetanus antitoxin were injected; if earth, 1500 c.c.

Field and mobile reserve hospitals were located with special reference to availability of buildings and to facilities for evacuation, as a rule, out of the range of the enemy artillery. A grave drawback to putting hospitals far to the rear was the time it took patients to reach them, sometimes two or three days. This was especially serious because nearly all wounds were infected; in cases of gas phlegmon or tetanus, the mortality rate rose very fast if hospital treatment were delayed.

Upon reaching the hospitals, the wounded were bathed, their hair trimmed, and they were rubbed with a 10 per cent sulphur ointment to keep vermin out of the wards.

[Standard Hospital Barracks. *Scientific American,* Sept 8, '17. 450 words.]

In the vicinity of Hamburg, Germany, are shops which turn out a great number of hospital barracks, completely equipped. Even the window curtains, the stoves, the chandeliers and the medical outfit are made here and added to the ensemble before shipment. The barracks are of standard dimensions, 15 meters in length and five in width, with walls 2 1/3 meters high and a ridge pole 3.65 meters from the ground. They accommodate 18 beds. The total weight of each barracks is about 8800 pounds. It is made so conveniently for transportation that the parts of 3 barracks complete can be carried in one freight car.

—Railroad

See

SANITARY SERVICE—TRANSPORTATION OF SICK AND WOUNDED—HOSPITAL TRAINS

—Ships and Boats

See also

SANITARY SERVICE—NAVAL MEDICAL SERVICE

HOTZENDORF, Conrad von

[Conrad v. Hötzendorf. Anonymous. *Schweiz. Zeit. f. Art. u. Genie,* Jan, '16. 1200 words.]

(An account of his military writings.)

HOWITZERS

See

FIELD ARTILLERY

MOUNTAIN ARTILLERY—MATERIEL—HOWITZERS

[The French 29.3 cm. Howitzer. Anonymous. *Schweiz. Zeit f. Art. u. Genie,* Aug, '16. 1000 words.]

The French have encountered many difficulties in overcoming the advantage which Germany and Austria had in heavy and fortress artillery. Recently a new 29.3 cm. howitzer, originally made by Schneider & Co., for Denmark, has been introduced. The weight of the tube and breech mechanism is 8100 kg.; of the gun and carriage complete 36,500 kg. It is an all-around fire mortar. Weight of projectile 300 kg. At 40 degrees elevation and with 300 m. initial velocity, the range is 11,000 m. At maximum elevation, 65 degrees, the range is 8000 m.

HYDROAIRPLANES

See also

AERONAUTICS

AERONAUTICS—NAVAL USES OF

—Design of

[Seaplane Forms. By C. G. MacGregor. *Aviation,* Mar 15, '17. 3380 words. Illustrated.]

The float of a seaplane is the part of the machine which enables it to float on, rise from and alight on the water. As the seaplane must be able to put to sea in anything but life-boat weather, the float or floats must be built strong enough to withstand the enormous impacts to which they are subjected. The floats should have an excess buoyancy of from 70 to 150 per cent. of the weight of the complete seaplane in its loaded condition. As there is always the danger of encountering a submerged rock or stump the float is divided into several water-tight compartments, usually about six. All floats should have sufficient longitudinal stability when pitching to prevent the machine falling back on its tail or forward on its nose and have sufficient lateral stability to eliminate any undue rolling over on the wing tips. To keep the wing tips from dipping when the machine is heeled by a sudden gust of wind, small floats are attached to the extremities of the wings. In order to facilitate steering when the seaplane is running at low speed on the water, the tail float can be made to turn with the rudder and so act as a ship's rudder.

For good all around service the twin float landing gear is very satisfactory. However, the two floats must not be too far apart. The tail float must still be used when the main floats are short, but the wing floats can be dispensed with. The ordinary float has one or more steps built in the bottom transversely and one ahead of the other to break the contact with the water. The top of the float should have a slight camber and by curving the deck down to the tail without a break, great strength is obtained.

The wing floats are made of either wood or metal, wood usually being most satisfactory. They are usually stream line in shape. The interior is divided into two or more water-tight compartments.

The main floats are classified as: stepless, single step and multiple step floats. The stepless float is practicable up to lengths of only fifteen feet; for longer

floats it is very difficult to get the machine off the water. The single step float is the one most commonly used. The best position of the step is between 6 and 36 inches abaft the center of gravity of the machine. To prevent spray being thrown up onto the machine spray strips are attached to the outer edges of the planing surfaces.

—Floats

[Floats and Hulls for Flying Boats, by D. S. Simpson. *Aerial Age Weekly,* Sept 24, '17. 2360 words. Illustrated.]

For many reasons the demand for water flying machines is becoming greater. Since the first machine got off the water eight years ago the development has been along two lines; the flying boat in which the fuselage and floating body are one, and the sea-plane proper in which the wheels of the landing gear of an air plane may be said to be replaced by floats. The latter type is again split into two groups, the single and double float types. The single float will probably always be used when speed in the air and a maximum of cargo space are called for, just as the double float type will always be used when it is desired to carry torpedoes or large sized bombs. The single float type is excellent in smooth water as far as ease of landing is concerned but has to have two small floats, one mounted on each wing to keep it on an even keel. Unfortunately the water is not always smooth and the wings get very severe strains in rough water by the wing floats striking the waves. While the two-float type is harder to handle due to the machine yawing, the strain is all taken up in the chassis and not transmitted to the wings. In the two-float type each float usually has about 75 to 90 per cent buoyancy. The single float usually has about 110 to 125 per cent buoyancy. The form of float used to-day has been developed from hydroplane design and experiment in the tank. The shape of the entire float is determined by the resistance to the air and the ease with which it can be raised from the water. In designing the float the planing speed is made the same as the speed at which the machine will just fly or the low flying speed of the machine. As the weight of the engine and machine are fixed, the only variable for the float designer is the beam of the float. In order to estimate the speed for any set of circumstances we use Mr. Clinton Hope's formula:

$$\text{Speed in knots} = \sqrt[2.4]{\frac{\text{P.C.L.}}{\text{W}}}$$

In this the knot is equal to 1.15 miles.

P is the B.H.P. of engine.

C is 138,950 B/L, L is the length in feet of the pontoon to the step.

B is the beam of the pontoon in feet and W is the weight in pounds of the machine complete including the crew.

From an inspection of the above, it is seen that the plane cannot be continued indefinitely without the float getting too deep in the water the plane is broken speed can be controlled by modification of the beam. In the two-float type the beam should be about 25% more than that given by the above formula.

Weight is the most important item after form, and this is largely a matter of construction. The average weight of a pontoon is .089 pounds for each pound of its total submerged displacement. In the Richardson type, which combines the most favorable lines with respect to air resistance and the lightest possible section from a builders standpoint, the ratio seems to be about .073. The most critical test of a float is the moment that it leaves the water. The larger sea plane floats have a "V" bottom, as it relieves the jar in landing and the machine does not have the tendency to porpoise in getting away. In order that a hydroplane may ride on the water the planes must be set at a small angle to the horizontal line of advance. As this off sharp, thus forming the step. If the float is under twelve feet long the step is unnecessary. The step should always be located not more than three feet in back of the center of gravity. The main float must be made to extend far enough forward so as to prevent the machine tipping forward. To avoid carrying a tail float most builders extend the main float toward the stern and have what is commonly known as a one step float. Just as sharp corners are put under the water so round corners are placed above the water. The float should be fitted with a drain plug for each water tight compartment under the water, an aluminum hand hole plate above the water directly over the drain plug and a towing ring in the bow.

The curved deck of a float allows the water to run off easily.

HYDROGEN

—Production of—For Balloons

[Hydrogen for Military Purposes. By Lieut.-Col. de F. Chandler, Sig. Corps. *Aerial Age Weekly,* July 16, '17. 2600 words. Illustrated.]

The iron contact process for production of hydrogen is often referred to as the regenerative steam and iron method, the principle being that when steam passes over red hot iron it is decomposed into its constituent elements, the iron absorbing oxygen from the steam and the hydrogen collected. The commercial equipment for production of hydrogen by the iron contact process utilizes the well-known water-gas process for making the carbon monoxide which is needed to reduce the iron from the oxide to pure metallic state. The water-gas generator is filled with coke which is heated to redness by a blast of air for a very brief period. When steam is turned on to this very hot coke, it is decomposed; the oxygen freed from the hydrogen is combined with the carbon of the coke forming carbon monoxide (CO). The water-gas consists principally of hydrogen and carbon monoxide but must be passed through washers and purifiers to remove dust. The purified water-gas, usually referred to as "blue gas," then is stored in a holder, available for use as reducing agent. Temperature is a most important factor and must be constantly watched.

HYDROGEN—Continued

At least two firms in this country install iron contact plants, which produce 3,500 cubic ft. of hydrogen per hour. Hydrogen produced by the iron contact process has a purity of at least 98 per cent. It is claimed that hydrogen can be produced by this process from 25 cents to 75 cents per thousand cubic ft.

During the war between Russia and Japan both armies used field hydrogen generators employing the chemical reaction of alkaline hydrates upon aluminum. Sodium hydrate is preferred to the potassium hydrate on account of the lower cost of the soda. An iron basket is filled with aluminum scrap, lowered into the solution of caustic soda, the cover being immediately clamped to make it gas tight. The gas passes from the generator to a washing and cooling device which removes the traces of alkaline matter.

In the generator the aluminum is attacked by the soda solution with great energy, the gas coming off rapidly and the liquid heating to the boiling point, but as the proportion of free soda in the solution diminishes, the rate becomes slower. According to the theoretical computation, it is found that to produce 1000 cubic ft. of hydrogen there are required 224 pounds of caustic soda and 51 pounds of aluminum. With caustic soda at 3 cents per pound and aluminum at 50 cents per pound, the cost of the one thousand cubic feet of hydrogen by this process is $32.22. The actual quantity of materials to be carried will be considerably in excess of 275 pounds and the cost per thousand more than the foregoing computation indicates.

"Hydrolythe" is calcium hydride (CaH_2) manufactured by heating pure metallic calcium in retorts containing hydrogen. To produce hydrogen it is only necessary to drop the granulated hydrolythe into water. The reason hydrolythe is not more extensively used is on account of its high cost. At 80 cents per pound for hydrolythe the cost of 1000 cubic feet of hydrogen by this method would be $47.20.

The hydrogenite process is a modification of the "silicol" process. Pulverized ferro-silicon and caustic soda properly proportioned are thoroly mixed and preserved in hermetically sealed cartridges, each containing 50 kilograms. The field generator to use these cartridges consists of a metal container slightly larger than the cartridge, having a lid which can be clamped down gas tight. After placing the cartridge in th apparatus, the top of the can is opened and the mixed powders ignited. Around the inside of the cylindrical burning oven in which the cartridge is placed, is a trough to contain a measured quantity of water. The heat produced by the burning of the chemicals quickly converts this water into steam, the silicon, soda, and water combining so as to free the hydrogen.

When the mixture is first ignited, the air in the chamber and products of combustion are permitted to escape until the pure hydrogen appears. Even with the greatest care the generators are frequently destroyed by explosion.

A German chemist developed and advocated some years ago the production of hydrogen for aeronautical purposes by first manufacturing watėr-gas in the usual manner, passing the water-gas over red-hot calcium carbide in the form of powder. The hot calcium carbide decomposes the carbon monoxide forming lime and leaving carbon in the form of crystalline graphite. The inventor claims hydrogen of 99 per cent purity.

A French chemist a few years ago advocated the generation of hydrogen for aeronautical purposes by mixing aluminum filings with pulverized bichloride of mercury and potassium cyanide. After these ingredients are thoroly mixed hydrogen will be produced by adding water. It is stated that experiments indicated 187 pounds of this material were required to produce 1000 cu. ft. of hydrogen. In 1901 Mr. H. Houbon, a resident of England, invented and patented a process for making pure hydrogen from acetylene. He compressed the acetylene to five atmospheres and ignited it by an electric spark. The carbon precipitates in the form of fine soot leaving the pure hydrogen. It is stated that the process is very cheap and without danger. It is found that 180 pounds of calcium carbide are required to produce 1000 cu. ft. of hydrogen by this method. About four years ago the *Scientific American* described equipment designed for the German army for the generation of hydrogen by the method of decarburizing hydro-carbon oils. The main part of the equipment consisting of two gas producers. To fire them to the proper heat required from one to two hours. Crude petroleum or any petroleum distillates are first vaporized and then passed thru the producer ovens containing the hot coke, which decomposes the oil. After about twenty minutes the coke has been reduced in temperature so much that it is necessary to heat it again to redness by hot air blast.

The gas produced is passed thru water scrubbers and purifiers to remove sulphur. The resultant gas is said to be 98.4 per cent hydrogen, 1.2 per cent nitrogen, and 0.4 per cent carbon momoxide, and to have a specific gravity between 0.087 and 0.092.

ILLUMINATION

See also

SEARCHLIGHTS

[Radioactive and Luminous Compounds. By Capt. A. E. Macrae, pac., R.A. *Jour. Royal Artillery*, Sept, '16. 6000 words. 4 figs.]

During the present war much use is being made of luminous agents for illuminating watch dials, compasses, etc., a use which undoubtedly will largely increase in the future, especially for gun-sight scales and quadrants.

By a radioactive material is meant a substance, of which uranium, thorium, and radium are the best known examples, which is capable of spontaneously emitting special types of radiation.

These luminous compounds may be divided into two general classes:

(a) Radium compounds and radium paints.
(b) Luminous or daylight paints.

The former give a green colored luminosity, are independent of daylight, and contain a small percentage of radium or meso-thorium. The latter give a lavender colored luminosity which is obtained by storing up daylight and emitting it at night.

The starting point of radioactive transformations was the discovery by Röntgen of the X-rays in 1895, and Linard's experiments on Kathode Rays. Later Mme. Curie discovered radium which is found to exist in radioactive minerals.

Research work on the nature of the energy, soon discovered, by their effects, three classes of rays, viz., α, β and γ rays. Of these, the α rays are the most numerous, characteristic and important, and show a remarkable power of causing a fluorescence in many chemical compounds, and also in some metals. It is this property which is made use of in radium paints and compounds.

The radioactive compound at present being used for the illumination of gun sights is made up in a dry powder consisting chiefly of radium bromide and zinc sulphide. The powder is cemented into a small glass tube 0.34″ long and 0.092″ external diameter.

Radium paint of this compound is made by mixing the powder with a little mastic varnish.

In time the sulphide of zinc becomes exhausted while the radium still remains active, therefore, these compounds and paints should not be destroyed when they lose their luminosity, but should be saved in order that the radium may be recovered for use over and over again. If wearing a radium painted watch, care should be exercised in handling photographic plates or films, that they be carried in boxes of heavy materials, and on no account enter a dark room where sensitive plates are being developed without removing the watch, because of the action of the radium on such plates or films.

At present the best daylight paints are made up with sulphide of zinc, sulphide of calcium, or sulphide of barium. The sulphides are mixed with a little good mastic varnish and then applied to the surfaces, dried, and finally varnished for protection.

These paints are not self exciting and therefore are of use only where they can be exposed continually to daylight excitation previous to their being used at night. Their luminosity falls off very rapidly after the first hour or two of use at night.

—For Night Attacks

See also

Aeronautics—Night flying

Night operations

[Army Items. *Army & Navy Jour.*, Dec 2, '16. 200 words.]

Illuminating bombs were given a trial in night maneuvers at San Antonio. Sixty bombs were fired to illuminate the foreground of the trenches of the defending force. Each bomb provided a light which remained suspended in the air several minutes by a small parachute. The glare effectively illuminated the foreground.

IMPEACHMENT

[Impeachment, Past and Present. By Lieut. Colonel A. C. Yate. *United Service Magazine,* April, '17. 1800 words.]

(Historical.)

INCENDIARY BOMBS

See

Bombs—Aerial—Incendiary

INCENDIARY BULLETS

See

Bullets—Incendiary

INDIA

See also

Great Britain—Army—Service in India

—Army

See also

India—Military policy of

[The Inexpansiveness of the Indian Army. By Major Aubrey O'Brien, C. I. E. *United Service Magazine,* Feb, '17. 2400 words.]

India has sent troops to the Dardanelles, East Africa, Egypt and Mesopotamia; but for a long time these numbers were insufficient and question arose as to the reason of this and as to the remedy in the future. The strength of the army in India is based upon the British navy. With the sea on both sides and the Himalayas on the north, India can only be invaded on the northeast and northwest frontiers. An army of 160,000 is sufficient to protect these frontiers. The tribes eligible for this army are few and have constantly changed. The history of India is a series of conquests by the existing Indian army against other Indian tribes. But the history of the army has been a constant one of rejection of the original winning tribes in favor of those beaten, because the raw material, tho beaten, was generally considered better stuff to work upon. The tribes thus eliminated and scrapped relapsed into inanition, and their suitability as material for soldiers was soon gone. Then, too, the low-caste men are always barred from the army so that the higher caste men of better material can be obtained. The remedy is to encourage all classes to enlist that have any soldierly spirit left in them, and to remove the barriers of caste in such a way as not to discourage the better classes.

[An Indian Defense Force. *Army & Navy Gazette,* Feb 24, '17. 250 words.]

A bill for the establishment of an Indian Defense Force is to be introduced in the Imperial Legislative Council. This bill provides for the compulsory military service of all European British subjects in India; also, it provides for the voluntary enrollment of Indians for general military service in India for the duration of the war.

[Some Suggestions. By Conductor H. C. Parks, I.M.L. *Jour. United Service Institution of India,* April, '17. 2500 words.]

INDIA—Continued

(This article assumes that the war is over and that a general overhauling of the military machine is to be undertaken, with a view to making what is good excellent, and discarding those things merely "fairish" or "not too bad." It is wise to learn from any source, however humble. It is assumed that Indian Army Order No. 1 of 1920 calls for suggestions from all sources, and the remainder of the article consists of such suggestions as might originate from such an invitation. These suggestions cover many items such as uniform, paper-work details, time-saving methods, and many others. Under bayonet fighting and shooting, it is suggested that a soldier should fire on the range practically every day, and at unknown distances so as to acquire with the rifle the same facility that is credited to a cow-boy in the use of a revolver. Mottoes and maps for barrack room walls are suggested. A yearly increment of pay contingent on good reports is mentioned, with extra increments for especially good work. Promotions in rank to follow after a certain number of increments of pay.)

—History

See also

SERINGAPATAM, SIEGE AND CAPTURE OF

[A German Adventurer in India. By Colonel R. G. Burton. *United Service Magazine,* Jan, '17. 1600 words.]

(Short sketch of the adventurer Reinhard's career in India.)

[Extracts from a Journal of the Campaign of 1803 and 1804 in India. Kept by Cornet George Call, 27th Light Dragoons. *Jour. R. U. S. Institution,* Aug, '17. 11,000 words.]

(A day by day account of the campaign from Sept 4, 1803, to June 20, 1804.)

—Military Conditions in

See also

MOUNTAIN WARFARE (Article: "Frontier Mountain Warfare")

[India's Participation in the War. From *Streffleur's Mil.-Bl. Feldzeitung. Schweiz. Monatschrift aller Waffen,* Sept, '17. 300 words.]

Lord Hardinge, in the House of Lords, claimed that India could spare only an insignificant number of troops for the Mesopotamian campaign. He stated that India, in the first six months of the war, had sent away 80,000 English and 210,000 Indians. Of the Territorial troops which replaced the regulars, many were later sent to Europe or Mesopotamia. The strength of the English troops in India was reduced to 15,000. In view of disturbances on the northwestern boundary of India, and of the danger of revolution—7000 revolutionaries have gone to India from Canada and the United States—the viceroy has other things to think of besides sending troops to Mesopotamia.

—Military Policy of

[The Improvement in Strength and Efficiency of the Volunteer Force in India. By Major W. E. Crum, Calcutta Light Horse. *Journal United Service Inst. of India,* Jan, '17. Gold Medal Prize Essay, 1916. 5100 words.]

Auxiliary Services in India might be called upon to resist mobs, patrol railroad lines, defend stations, bridges, etc., and round up insurgent bands. It is the confident and almost unanimous opinion of British civil and volunteer officers that necessary efficiency and training cannot be attained except thru universal military training. There are three methods of obtaining a force: by persuasion, inducement, or compulsion.

Persuasion. Employers encourage their men to volunteer. Appeals to patriotism are made.

Inducements. Exemption from tax and jury duty: conferring honors on volunteer officers.

Compulsion. It has already received the emphatic support of all representatives of British trade in the country. Universal training is suited to India, but universal service is not.

Division commanders are responsible for the training of their officers. Regular and volunteer officers should be brought together for the discussion of problems of organization and tactics. The training of men must be practical and progressive. Commanding officers must draw up a course of annual training. Complete training of each individual is not possible, therefore divide into groups and specialize each group on one feature; e. g., entrenching, demolitions, bridge building, etc. Bring regular and volunteer troops together for instruction, and overcome diffidence between them by orders emanating from those in command of both.

Musketry. Prepare miniature ranges where full ranges cannot be provided. Field firing improves the musketry, discipline and morale of volunteers.

Arrange a system of transport by registering motor cars belonging to members. Volunteer organizations should have more machine guns. One machine gun is worth more than 100 riflemen in a street riot. A system of 40 drills a year, one a week leaving out the hot weather months, should be required, together with a number of whole days in camp. The uniform of officers and men should be paid for. Funds to meet expenses of field days and camps should be adequate, without drawing on regimental funds.

Commanding officers are now without authority to enforce discipline. It is difficult to give them this authority, as any attempt to add strictness causes men to resign. Those who would remain are men who are worth while even under the volunteer system.

"Numbers without a system of training; training system without sufficient funds; ample funds without power to compel men to serve and spend them—are all useless."

[The Improvement in Strength and Efficiency of the Volunteer Force in India. Gold Medal Prize Essay Competition—1916. By Col. H. A. Young, C.I.E. *Jour. United Service Institution of India,* April, '17. 5500 words.]

All military questions are in a state of flux and it is hardly possible to forecast either the political or mil-

itary conditions in India after the war. The discussion of the question is divided into two parts, the first dealing with facts and deductions therefrom, and the second with possibilities and suggestions.

PART I

The Volunteer Force has existed since the early days of the British occupation, was allowed to die out in the early years of the 19th century, but several corps were enrolled during the mutiny.

The numbers of the volunteers are tabulated and show a gradual increase from 27,650 in 1892-3 to 50,219 in 1914-15. Of late years, an average of about 95 per cent is rated as "efficient." It is impossible under the present budget system to ascertain the real annual cost of maintenance. The object of the Volunteer Force is for local service in the civil districts in which they are enrolled. They were never intended to form up in line of battle with the regular army, but merely to relieve it of part of the work in maintaining internal order and in the defense of the principal parts.

The returns show 96.5 per cent of the volunteers to be "efficient" but this efficiency is to be judged from the standard set by the authorities. To become a trained volunteer requires attendance at 16 elementary and 4 corps drills, and a recruit course in musketry. A trained volunteer, to be classed as efficient, must attend 7 elementary and 2 corps drills and pass as a second class shot. A standard of efficiency calling for 9 hours' drill and 50 rounds annually with an accuracy of less than 50 per cent cannot be called high. The actual standard is higher than this analysis indicates.

The equipment is the barest minimum. A rifle, not always the latest pattern, and a few accoutrements are provided by the government. All the rest, clothing, machine guns, entrenching tools, etc., must come from some other source.

The volunteers have never been called out as a whole. They have been used to suppress local trouble and small detachments have been used with the regulars at times. The use of the volunteers in the present war has not been entirely made public. Small forces of auxiliary troops have been utilized, but the force is not organized, equipped or trained to relieve any considerable part of the European garrison or to furnish any appreciable reinforcement to the active army. After two years of war, the conditions are but little improved. Many suggestions have been made, but little change has been made or is likely to be made so long as the old ideas of the objects and value of the force are held by those in authority.

PART II

There are three ways by which the strength of the volunteer force can be increased:

1. By the exercise of some kind of pressure.
2. By the offer of more material inducements.
3. By improvements in organization and duties.

These methods are discussed in turn. Short of general compulsion, the first is not likely to lead to any satisfactory result. No practical scheme of material inducements can be devised which would have any real effect in increasing the strength of the volunteer force, tho some improvement might be made in this direction. In the third method there is some promise of results. An increase of efficiency will make the service more attractive to intelligent men. A definite place in the Imperial forces, good equipment, and conditions of service suited to private responsibilities should get all the men worth taking. But two things must be considered, the desirable and the possible.

There are three duties which the Volunteer Force can and should undertake:

(a) Assistance to the civil power in local disturbances.
(b) Substitution for the regular garrison in times of major military operations.
(c) Assistance to the regulars in the field by means of special technical and other units.

The first of these has been done repeatedly and effectively. The ability to do the second depends upon organization, equipment, and training. These should all be directed with the end in view. With a view to the third duty, volunteer corps should be asked to maintain special service sections, either by allowing extra strength without liability to service and trusting to volunteers, or by fixing a definite strength and making all contract to go on service if called. The special sections should be given a minimum of military drill and exercised as much as possible in their specialty. (Suggestions are made as to the nature of these special duties.)

The force organized, trained and equipped as suggested would cost more than at present. An efficient volunteer force cannot be created under the favorite phrase—"without extra expense to the State."

Before the war, the Indian Army Reserve of officers was a force with ridiculously small numbers and insufficient training. In January, 1914, there were 40 Reserve officers; in April, 1916, nearly 1700. Patriotism and a desire to see service have thus proved sufficient. The obvious source of supply of officers is the volunteer force and a well thought out scheme connecting the Volunteers and Reserve of officers would be of great value to both.

Men should be attracted to the Volunteer Force. Strength and efficiency go hand in hand, and no good man would want to be connected with an inefficient force. A definite place in the Imperial forces and thoro practical training will attract men and the idea that the least possible work will attract them should be discarded.

[The Improvement in Strength and Efficiency of the Volunteer Force in India. (Gold Medal Prize Essay Competition. 1916.) By S. G. V. FitzGerald, Esq., I.C.S. *Jour. United Serv. Institution of India,* April, '17. 5500 words.]

A couple of batteries of guns, a battery of machine guns, a few auxiliary troops, and a large number of untrained and half-trained officers—such was the contribution to the fighting forces of the Empire during the first eighteen months of the war from the Volun-

INDIA—Continued

teer Force in India, numbering nominally nearly forty thousand officers and men. In addition there were formed corps for the defense of four ports, and the support to the cause of internal order. But the Volunteer Force is never likely under existing conditions to be of direct value, and a root and branch revision of the whole system is necessary.

Internal Discipline.—There is difficulty here. Drills are few and attendances uncertain. Notwithstanding the existence of certain acts, the penal clauses are in fact a dead letter. Enlistment for a definite period with re-enlistment for a definite term, restriction on resignations, power to enforce existing acts, summary trial by order of the officer in local command of volunteers, and certain changes with respect to attendance at annual camps of exercise, all requiring legislation, are suggested as remedies. The first result would be a falling off in numbers, but a smaller and more efficient force would be an improvement over present conditions.

External Compulsion.—Universal service is not necessary to the efficiency of the Volunteers. In fact a species of compulsion is now exercised by subordinate authority and almost everybody affected is already a Volunteer. There is an almost unanimous demand by those affected that compulsory service should be provided for by law. There are certain objections to compulsory service, and an alternative is to impose heavy penalties on possible volunteers who shirk their duties, and on employers and others who present or dissuade them from fulfilling their duties.

Details of Administration and Training.—In Australia and New Zealand, compulsion begins in the cadet stage at 12 years. Cadet service is regarded as a preparation and not as a substitute for military service. Since cadets as such are not required to fight, exemption from cadet service on grounds of conscientious objection should not be allowed. (Here follows a discussion of the Burma Chamber of Commerce plan of adult compulsion, a plan having the great virtue of not asking too much. Among its provisions are:—compulsory service from 17 to 30; tax on foreigners in lieu of service; five years in the active citizen force, annually 25 drills of 1½ hours, six days in camp or five whole days at maneuvers, and a musketry course of not less than 150 rounds; three years in the first class reserve of twelve drills per annum and firing the musketry course; three years in the second class reserve, including a musketry course of 100 rounds every year; and three years in the third class reserve, with no training required. Officers and n.c.o.'s to be obtained from volunteers for additional five years in actual force; officers to be appointed on probation and confirmed only if efficient; service for three months with regular unit at some period of an officer's career; command of a regiment to be given only to thoroly competent officer, such a command to be made the greatest civil honor obtainable. Comments are made, on various phases of this plan, particularly on the training.)

Use in Time of War.—Restriction as to employment of the Volunteer Force should be removed except as regards the reserve, and the active force must be liable for service anywhere in India.

Officers' Training Corps.—Men suitable for officers are usually employed in positions of trust and hence cannot ordinarily be spared for military service except in case of actual need for their services. Even now, many cannot be spared. Nor do the Volunteers provide a suitable training ground. A scheme for an Officers' Training Corps subsidiary to the Indian Army Reserve is suggested. A scheme of examination for certificates similar to that in use in England is outlined. The necessary legislation for reorganization should be had while the patriotism of India is stirred by the war.

INFANTRY

—Arms

See also

BAYONET

[Armaments. By Lt.-Col. A. Vazquez de Aldana. *Memorial de Infanteria,* June, '17. 3600 words.]

Since the advent of the breech-loading small arm, the usefulness of the knife and of cutting weapons has been reduced to nothing. At present no officer, either mounted or dismounted, has any use for a sabre in action. With the exception of Germany, all belligerents have replaced the sword and sabre by the rifle and pistol, except in the cavalry. Sabre and fencing instruction has become a physical exercise only, and an inferior form of exercise. The Swedish exercises are the most valuable. No officer should forget the teachings of the war in Morocco, of the Mindanao campaigns, or of the Cuban campaigns, in which the sword was carried by order, and the rifle or pistol for defense and offense.

The firearm insures the essential preliminary to personal combat, which is keeping your opponent at a distance. The knife weapon is rendered harmless by distance between combatants. There are many means of avoiding the knife weapon, among which are guards, reposts and obstacles. This is not true of the hard-lead bullet, which cannot be parried and will penetrate the ordinary small obstacles. In an encounter a knife weapon is usually imbedded in the opponent's body, thus disarming the attacker. In the use of firearms some means for temporarily holding the adversary while aiming should be taken. This is the idea of the barbed wire entanglement, or any other obstacle which does not impair fire effect.

It must be remembered that, in the present war, the bayonet is used only to take trenches already captured by the artillery. The knife weapon has become nothing but a symbol, and no time should be lost in the instruction of its uses.

[Trench Weapons. *Scientific American,* Nov 10, '17. 185 words. Illustrated.]

Among the weapons used by a fighter in trench warfare are: a rifle, grenade-throwing gun, pistol, package of powder for use against gas attacks, grenades,

signal lantern, alarm bell for gas attacks, barbed wire, signal rockets, scoop, corrugated iron, shovel, huge pliers or cutters for barbed wire, broom, trench periscope.

United States

[Notes from Here and There in Mexico. Collected from Correspondence. *Infantry Journal*, Feb, '17. 3500 words.]

The infantry work of the Mexican campaign has been largely that of guarding the line of communication, which entailed considerable marching, constant patrolling and outposting, the entrenching of camps, and some escort duty.

The marches, which were over dusty and rocky roads like those of Southwestern Texas, varied from ten to twenty-seven miles. The men came thru in good shape under trying conditions of scarcity of water, great heat, wind and dust.

The strength of our companies constantly decreased. It would seem that in time of war there ought to be a system by which we can replace losses actually in the field. We do not want new units which are strangers to the situation.

One feature of the expedition has been the complete failure of the new unit equipment idea, and that of surplus kits. When transportation is limited, the base is getting farther away, and there is necessity for hauling rations, forage, ammunition and medical supplies, the surplus kit is out of the question. In addition, when sick men are sent back, the descriptive list and form 152 never reach anybody, or are never sent. Property is scattered anywhere between the home station and the truck driver whom the organization has had to arm without a chance of invoicing the property to anyone.

Camp sites are largely a question of water. On one occasion we made twenty-seven miles to a water hole that on account of the season of the year yielded one cupful per man. Wood, however, is never a serious question on account of the mesquite as a last resort.

As for transportation, there should be a truck train or three extra wagons with each regiment. It is believed the time has arrived when the infantryman's pack should be transported for him to the scene of battle. After a long march in full pack the value of infantry as a fighting machine is greatly reduced. The solution lies in transportation by motor trucks.

In regard to mess equipment, that of Equipment "A" is satisfactory, but should be supplemented with field ovens of individual manufacture. These every officer and mess sergeant should know by practice how to construct, since they add 75 per cent. to the mess. Buzzacott's rolling goulash cannons produced good liquid food, but were mule killers. Besides, the animals could have been used to better advantage for the wagons.

The best shoe we have had is the new issue shoe. On the march the men soon learned something that they failed to understand in garrison, namely, that their footwear should be ½ to ¾ oversize. The men prefer the leggin with the strap underneath on account of the rubbing of the present type against the tendon behind.

—Arms—Ammunition

See also
BULLETS

—Arms—Grenades

See
GRENADES

—Arms—Rifle

See also
LEE-ENFIELD RIFLE

[Note. *Army & Navy Jour.*, Feb 3, '17. 90 words.]

The Japanese Army has announced that Col. Kijiro Nambu has invented a new infantry rifle which, in comparison to the one now used in the Japanese Army, has a longer range, better internal mechanism, is more powerful in its firing capacity, and more convenient to handle.

[A New Military Rifle. *Scientific American*, May 12, '17. 500 words.]

A Brooklyn inventor has patented a new rifle which he claims eliminates various defects found in the present U. S. magazine rifle. He has substituted for the finger-trigger under the stock, a thumb trigger above the stock. This eliminates the derangement of aim likely to be caused by pressure on the finger-trigger. He obtains a long sighting range by attaching a peep sight to the firing pin, thereby eliminating the inaccuracy of shooting caused by a shorter distance between front and rear sight and by the rear sight's being from 12 to 18 inches from the eye.

—Arms—Rifle—Automatic

See also
MACHINE GUNS

[Another Vote for the Automatic Rifle. By Lt.-Col. Manuel Burguete. *Mem. de Infantería* (Spain), Oct, '16. 1200 words.]

The automatic rifle should not be limited to expert shots, but should be given to all soldiers. As collective fire has now generally replaced individual fire, it is more important to train the organization to distribute the shots over a given area than to teach the individual to hit a certain point.

Advantages of the automatic in collective fire: As the fire is usually by volley with intervening pauses, it follows that the greater rapidity of action of the automatic, other things being equal, gives greater intensity of fire and theoretically greater service. Again, when the enemy is caught at a temporary disadvantage, as in crossing an open space, or when it becomes necessary to support an exposed rush of part of our own line, the greater number of shots delivered by the automatic will be a particular advantage and give increased efficiency.

The argument that the automatic will increase the consumption of ammunition, even if correct, is no disadvantage, as the effect should be commensurate with the expenditure. On the other hand, as the col-

INFANTRY—Continued

lective fire is controlled by the leader, if the object of the fire can be secured in less time by the use of the automatic, the expenditure need be no greater and there will be longer pauses between fire and a consequent saving of time.

—Arms—Rifle—Manufacture of

[The Science of Small Arms. *Arms and Explosives*, June 1, '17. 250 words.]

Small arms problems cannot now be discussed freely, but certain general aspects may be alluded to. The science of small arms includes ballistics, musketry, mechanical engineering, explosives, commercial problems (factories), and design as dictated by military requirements. The science is highly complex and there has been lack of co-ordination, and every possible effort should be made in the future to secure it. Heretofore the science has not thriven because regarded as a sub-department of artillery. The current object-lessons should be brought to the attention of those in authority.

—Arms—Rifle Sights

[The Telescopic Rifle Sight in the United States Army. *Scientific American*, Dec 2, '16. 1000 words. Illustrated.]

The telescopic sight for military use was first developed in the United States. The average poorly trained man can see better than he can hit with a rifle, so his sight needs no assistance. But experts are handicapped by limitations of sight and they can profit by the telescopic sight. The sight is of 6 diameters magnifying power, and is attached to the rifle over the receiver. It is removable and is normally carried in a leather pouch. The sight is set for range by turning a large milled disc. The graduation is to 3000 yards.

—Attack

See also
ATTACK
INFANTRY—COMBAT
TACTICS (Article: "Modern Battle Tactics")

[The Infantry Advance as Related to Artillery Fire. By Col. Vernengo. *Rev. del Circulo Militar*, Sept, '16. 6000 words.]

The original deployment of the main body of infantry should be made in rear of and normal to the artillery line. Passage thru the artillery should be made thru the intervals between artillery groups so as to interfere least with the artillery fire.

A convenient formation for passing thru the artillery is by battalion in line of company columns with intervals of fifteen meters between companies; other suitable formations are columns of companies or double column.

The advance thru the artillery should be made rapidly and the deployment into firing line, etc., can be safely effected at 100 yards in front of the guns if the artillery is firing at ranges of more than 2000 meters.

In general terms the object of the artillery is to facilitate the infantry advance. Its method of accomplishing this can best be understood by considering the several phases of the attack. In the first stage following the development into line, the infantry is mainly concerned in gaining ground to the front and avoiding casualties. At this stage the artillery will be engaged with the hostile artillery, which alone can inflict losses on our infantry. After our infantry has opened fire, the artillery target will be that arm of the enemy which for the time being most seriously opposes the advance of the infantry. The successful co-operation of the artillery during this phase of the attack requires perfect understanding between the higher commanders, and to a lesser degree between leaders of the smaller units of both arms.

The infantry must not expect the artillery to beat down all obstacles in its path; these it must strive to overcome itself, realizing that it is the principal arm and the artillery only an auxiliary. As much of the artillery fire as possible at this stage of the action should be turned against that part of the hostile position upon which the main assault is to be made. It should endeavor to demoralize the defense, and this will be best effected by sudden bursts of fire, brief and violent.

Just previous to the assault proper, the artillery fire should be continuous and crushing. The guns should be brought as near to the hostile position as possible, 2000 to 2500 meters, regardless of the fire of the enemy infantry.

Great care is here necessary that the artillery does not inflict losses on its own troops. The flank guns should open with a range greater than that estimated and diminish successively until the correct range is to cover the ground in rear of the position or to op- to the assault the artillery fire should be directed against another part of the line, or the range increased obtained. At the moment that the infantry advances pose a counter attack.

Only by intelligent handling and constant communication between the two arms can the combined action be secured in the critical moment preceding the assault.

—Combat

[Tactics and Fire—Regulations for the Tactical Instruction of Infantry (continuation.) By Major Eduardo Pérez Ortiz. *Mem. de Infantería* (Spain), Oct, '16. 3000 words. To be continued.]

The advancing echelons should take advantage of all features of the terrain, but must be careful not to lose cohesion or direction. Intrenchments should be resorted to as little as possible in the offensive, though such measures will undoubtedly be necessary at times; the officers must make every effort to conserve the offensive spirit, and when the opportunity arises such shelter should be promptly abandoned and the advance resolutely resumed.

The responsibility of the commander in the infantry combat is very great. He must regulate and control the advance, concentrating the efforts of his troops on the point of attack. Any failure to act or lack of decision on his part places the outcome in the hands of fate, and in the face of a well organized enemy the result is usually disastrous.

It is usual to combine an attack on one or both flanks with the attack in front. When the situation warrants it the troops for the flank attack should

move direct to their positions from the order of march. This presumes full information of the enemy's strength and dispositions or great numerical superiority in the attacking forces; lacking these elements the flank attack is usually made by an extension of the front, using for this purpose troops of the second line.

The flank attack will be most effective when it comes as a surprise to the enemy and is directed at a decisive point. The combination of the frontal and flank attacks requires careful calculations of times and spaces and a perfect system of communication between the attacking forces.

When the enemy has been driven from his position, such bodies of infantry as are near at hand and in condition to do so should be rapidly advanced to positions from which they can open a vigorous fire on the enemy to prevent his reorganization and to assist those troops specially charged with the pursuit.

If it becomes necessary to withdraw, the withdrawal should be made by echelons and with the best order possible, covered by the fire of the artillery and the cavalry. The latter should threaten the flanks and charge if necessary.

Reserve infantry and machine guns should occupy strong positions behind which the firing line can be assembled and prepared for a renewal of the attack.

In the attack against a strongly intrenched position, greater caution must be exercised. The advance will be slow, taking advantage of all shelter afforded by the terrain, and making use of field intrenchments. When the advance can no longer be continued without useless sacrifice, advantage must be taken of darkness and the new positions occupied must be strongly intrenched and well provided with machine guns. Communication trenches must connect the firing line with the second and third line troops.

Arrangements for the assault must be made with the greatest secrecy. The troops should be assembled as near to the hostile position as possible and well provided with hand grenades. At daybreak a bombardment should be opened by the artillery, machine guns, and trench mortars to destroy the hostile trenches and barricades and prevent the advance of enemy reinforcements.

If the assault succeeds, the enemy should be followed into his second line trenches; if the attack fails, the troops should withdraw rapidly under protection of a bombardment similar to that which preceded the assault.

—Drill Regulations

See also

MACHINE GUNS—DRILLS AND DRILL REGULATIONS

—Fire—Instruction and Training

See also

INFANTRY—INSTRUCTION AND TRAINING

[Reflection on Instruction in Rifle Firing. By Captain Friederich. *Revue Mil. Svisse,* May, '16. 1500 words.]

The war seems to establish clearly the efficacy of individual fire. It would seem that our standard has not been high enough. The criterion of the quality of a shot should be given by the size of a man's head at 300 meters.

The expression "cone of fire" should never be used in the presence of troops. The firer should know nothing about the collective effect of fire; he should be acquainted only with the effect of each one of his shots. In bayonet fencing, the man is taught to strike his adversary and not to produce a mass effect by thrusting indiscriminately against men and against intervals. The probable hits in a bayonet assault are not calculated; why calculate them for fire?

The classic faults of the firer are well known: they are mostly too much or too little front sight, the canting of the piece and the jerking of the trigger. This last defect is the most serious and difficult to correct. Nine times out of ten it results from the fact that the recruit does not press the butt hard enough against his shoulder for the first shot. The man who has profited by the preliminary exercises aims correctly, fires quietly, and scores a hit. But the recoil of the gun too loosely held has bruised his shoulder and, for the second shot, he flinches, closes his eye and jerks the trigger.

The officer who looks at the target when a man is firing would do better to look at the man. It is his shoulder which should be pressed by the butt (and not his biceps), his eyelid which must be motionless, his right hand clasping the small of the stock, his index finger pressing the trigger on the second joint.

The belief is current abroad that the Swiss is a born shot or, at least, that he becomes a good shot early. This opinion is flattering and advantageous for us, but it is false. We do not shoot better than some foreign armies and we are the more to blame because we could. It is chiefly a question of attention and conscience on the part of those giving instruction. The most frequent fault is, beyond a doubt, the jerking of the trigger: it may be avoided by a strong pressure of the butt against the shoulder. This is prescribed in the regulations but almost never enforced.

[Combat Firing. By Major I. Téllez. *Mem. del Ejército* (Chile), Oct, '16. 1700 words.]

Maneuvers, especially for larger units, are the final test of instruction. For the smaller units (troops, companies and platoons), combat firing may be considered as a final examination, not to be dispensed with, if it is desired to obtain an accurate knowledge of the state of efficiency and of preparation of troops for war.

There are officers, who, during field firing exercises, exert themselves to obtain a high percentage of hits. This demonstrates that they have no conception of the real meaning of such exercises. Except in extraordinary cases, and just for a few moments, not even one per cent. of hits is obtained on the battle field.

General Von Bülow, after a company of the 20th Regiment of Infantry had completed its field-firing problem, and after the officers had been assembled, asked the Colonel of the Regiment, if he was ready for

INFANTRY—Continued

the critique. The Colonel replied: "Sir, we are waiting for the data regarding the percentage of hits obtained." "What for?" asked the General. "Do you think I came here to see if the soldiers fire well? That information I can obtain from books. What I do want, is to take advantage of the main object of the exercises; that is to inform myself of the tactical preparation shown by the officers and troops."

It is believed that the logical classification of ranges should be as follows:

1. Long ranges: for distances beyond 1000 meters;
2. Mid ranges: between 800 and 1000 meters;
3. Short ranges: between 600 and 800 meters; and
4. Decisive ranges: under 600 meters.

As a general rule, at long ranges combined sights are used and each company has a firing sector assigned to it, which in turn is divided among the platoons. At mid ranges, the use of combined sights is the exception; the firing sectors are divided among platoons, and, under favorable conditions, among squads. At short ranges, only one sight is used; and, as far as practicable, each squad should have its sector designated. When it comes to decisive ranges, a decision must be looked for. Each squad should have its own sector designated, and, whenever practicable, a further subdivision made within the squad.

A director assigned to a company should observe closely the company commander, from the time the latter dismounts, taking notes of everything which is not in accord with actual conditions. Special attention should be paid to the following points: initial orders given to the company, assembling of officers, any reconnaissance ordered, formation adopted, selection of the first firing position, distribution of sectors, manner of giving orders, etc.

The duties of the umpire increase when his attention must be directed to the platoon leaders and men.

The critique following the exercises should be more detailed and exacting than that given at any other time. It is then that the degree of preparation of officers and men can best be judged.

[Résumé of Infantry Instruction in Rifle Fire for the Year 1915. Prepared by the Third Section of the Central School of Fire. *Mem. de Infanteria,* Nov, '16. 6000 words.]

This article is a comparative study of the results attained in the course of instruction for fire for the year 1915, based on the statistical reports submitted by the regiments and battalions taking part in the course.

The subject is treated under the following heads:

Instruction Fire, preparatory and record.

Instruction in combat fire.

Control and employment of fire.

Exercises for officers, including estimation of distances, slopes and elevations, designation of objectives and study of the terrain.

Exercises for sergeants, corporals and selected privates to prepare them to assist in adjusting the fire by approximating errors in range, elevation and direction.

Combined Exercises—simulated and real fire.

Pistol Fire, for officers and non-commissioned officers.

Firing Material.

Armament and Munitions.

General Observations.

Increasing interest is shown by the greater number of organizations completing the course and the greater amount of work accomplished.

A marked improvement is shown in the instruction practice of the soldier, but the general improvement does not meet with expectations based on the progress of the preceding year. Many officers did not carry out the prescribed courses, and the results in this respect were not satisfactory.

It must be recognized that the fire efficiency of the troops depends as much on the ability of the officers to control and direct the fire as upon the skill of the soldier with the rifle.

(A summary in the form of a table is appended, expressing in percentages under the headings good, average and deficient, the results attained in each element of the course.)

—Fire—Instruction and Training—Musketry

[Naval and Military Notes. The Value of Rifle Shooting. *Scientific American,* Aug 18, '17. 250 words.]

The *Army & Navy Gazette* of London, states that the military authorities have not lost sight of the value of good rifle shooting. Musketry is taught at many schools behind the front, and the result shows up in the report of the wonderful rifle practice made by the British troops in the fighting around Bullecourt.

—Fire—Instruction and Training—Target Practice

[Target Index Machine. By B. E. *Voenny Sbornik,* June, '16. 1000 words.]

(This article is a detailed description of the Target Index Machine, which is quite well known in this country and is used by many of our infantry and cavalry organizations. The description is therefore omitted from this review. An effort is apparently being made to introduce the machine into Russia, where up to the present time it appears to have been unknown.)

[Musketry Training. Varied Ground. *Infantry Jour.,* June, '17. 850 words. 5 illustrations and 1 table.]

In the future the time spent on the target range by any one regiment must be short, and the use of service ammunition limited. To attain a high state of proficiency with a minimum expenditure of ball ammunition, it is necessary that soldiers master the technique of rifle shooting before going on the range for service practice. This necessitates the employment of gallery rifles and gallery ranges to a greater extent. The following system of training used in the British service has given excellent results:

CLASSES OF PRACTICE

(a) *Grouping practice:* This is to train the soldier in the beginning of his shooting, to shoot consistently, judging by the size of his group of shots. It is fired with fixed sights at a fixed aiming point. When the grouping of shots is satisfactory, the soldier progresses to the next stage.

(b) *Application practice:* This trains the soldier to adjust his sights or aiming point in order to bring his group of shots into the desired part of the target.

(c) *Snap shooting:* This is done at a bobbing target which remains exposed for several seconds. It teaches the soldier to get off an effective shot in the least possible time.

(d). *Rapid fire:* This means the firing of as many effective shots as possible within a given time.

All the firing is done at 25 yards from the prone position. The targets are triangular in shape, a hit counting 5, 3, or 1, according to the triangle in which it lies. Upon some of the targets are superposed the figure of a soldier, shown as charging, or as firing from the prone position, the various sizes representing the object as it would appear at ranges of 300, 400 and 500 yards.

The course is divided into two parts, the first consisting of grouping and application practice, two series of five shots being fired in each. The soldier must qualify in this before he can progress to the second part, which consists of grouping practice, one series of five shots; application practice, one series; snap shooting, two series; and rapid fire. The standard for measurement in grouping practice is a 3-inch wire ring.

The course may be repeated if time is available, the conditions being made progressively more difficult. By using miniature landscape targets the subject of fire distribution may be taught the squads.

[Course in Rifle Training. By Lt.-Col. W. H. Whigham, 1st Illinois Cavalry. *Infantry Jour.*, Aug, '17. 1000 words.]

(Notes on a rifle course used by an organization on the Mexican border last year. It is based on the idea that that good short range shooting is of first importance and that 300 yards is far enough for specially aimed single shots. Details of course given, comprising aiming, sighting, and position drill; firing with .22 caliber at 50 feet; with .30 caliber at 50 feet; at 100, 200, 300, and 500 yards; "A" and "B" targets used, slow and rapid fire, all positions; platoon firing at each range at special targets; field firing at unknown distances; and firing by selected men at long range. The advantages of this course are set forth.)

—Fire—Rifle Shooting

[Rifle Shooting in Future Wars. By Edward C. Crossman. *United Service Magazine,* Jan, '17. 4400 words.]

Inexpert correspondents have taken the rifles from the hands of modern infantry, and have saddled them with machine guns, one to every man. One of these inexpert gentlemen should try marching, say ten miles, with nothing over his shoulders but enough ammunition to feed one machine gun for one minute. Modern small arms and shrapnel drove armies into the ground; the huge increase in the blasting power of modern artillery may make "going to the ground" most undesirable so long as open field operations are at all feasible. The ground is failing us, just as fixed fortifications failed us before the terrific rending power of modern high explosives, hurled by the enemy in half-ton lots. Deepening the defences means merely that the men in them are buried so much the deeper. Future wars cannot be judged by the present one, in which queerly enough all the fighting is on more or less restricted fronts. Fighting in such a country as the United States or Canada could hardly resolve itself into a condition of trench stalemate; the distances are too great, the defending and the attacking forces too scanty in numbers.

Without doubt, infantry of the future will, through the use of self-loading rifles of generous magazine capacity, be able to deliver a far more rapid fire than at present, but not with machine guns. Weight of infantry euipment will continue to be an item of the greatest importance, and infantry cannot be burdened with much more ammunition than it now carries into battle. While motor transport has solved to some extent the problem of moving part of an army from one position to another, it can never move the main body. Infantry must always be mobile; it must get there first and get there quickly, and to this end every other consideration must be subordinated. A machine gun to the squad and sufficient ammunition to keep the guns running are most desirable—but this would entail making a huge transport miles long, out of every regiment. Infantry cannot carry machine guns, and infantry cannot carry machine gun ammunition.

The machine gun of the refined type weighs not less than 30 pounds. Ten thousand rounds—certainly the minimum per gun—weighs approximately with its containers, 750 pounds, or say 800 pounds for gun and its ammunition, a small matter of more than a ton weight for every three guns. This ammunition supply would allow a rate of fire of a third the maximum capacity of the gun for a single hour. On the fixed front the machine gun will play an immensely important part in the future, a part that the British are just learning now from the machine gun masters, the Germans. Yet in spite of this, quick marching infantry armed with rifles is superior to weighty, ammunition-eating machine guns, when the fight is in the open.

All the improvement in fighting machinery has not decreased the usefulness of infantry nor made less potent the fire of the machine rifle. No machine ever designed equals the marvelous one which transports itself and carries its own ammunition for most of the day's fight, which gets up and removes itself when danger presses, which puts thousands of bullets on a given mark from a source so scattered that no effort of the enemy can suffice to more than push it back, and which at a signal gets up and fades away through

INFANTRY—Continued

wood and field, regardless of whether the road is blown up or whether a wheel or two comes off. Machinery is wonderful, but the human machine in the shape of the well-trained infantryman is the most wonderful of the lot.

Improvement in the fighting equipment of the infantryman in the future will lie in the direction of reduction of the weight of the ammunition—possibly thru improvement in cartridge case matériel and in reduction of the bore—and in raising the emergency rate of fire of the rifle. Already newspaper reports inform one that German rifles on the eastern front are being refitted with 25-cartridge magazines. The need for an extremely high rate of emergency fire for a few seconds, and the desirability of delivering this with as little disturbance to the aim as possible, point directly to the coming of the next rifle, the self-loading arm, recoil- or gas-operated, holding not less than ten cartridges, and preferably of a caliber not more than .25-inch. A rifle of the self-loading type must be arranged to permit of hand-functioning, and should be operated normally in this way. Only in cases of emergency should the semi-automatic feature be used. In addition, everything points to the desirability of reduction in caliber and weight. The smaller bore and lighter bullet go hand in hand with lessened weight for the complete cartridge.

Aside from the mechanical part of the infantry equipment, the war has not shown that there is any particular necessity for change in the qualifications of the infantryman. He must know more bayonet fighting, and he should be able to pitch a few fancy curves with hand-grenades. Certainly he ought to be able to shoot. The one thing that the war has shown is that the ability to point straight the magazine rifle is the greatest asset of the infantryman. Straight shooting saved the British time and again in the great retreat from Mons. Instead of proving that ability to shoot there or thereabouts was sufficient for modern warfare, the great work so far has shown the desirability of the highest sort of marksmanship. Where the infantryman could leisurely lie and spray with a sort of devil-may-care fire thin lines of skirmishers at a half mile, now he may be suddenly confronted by infantry erupting from a wood a quarter-mile away in mass formation, and will have to dam and sweep back the flood with his bullets. The one aimed shot, fired without yanking the trigger off the rifle, is worth the other nine that are squibbed off merely because it is stylish to be shooting. The cool handful of Boers, snuggled into their ridiculous trenches along the Tugela, taught the British once and for all that the skilled man behind the rise is worth a hundred brave men who hope to impose bulk of flesh and blood against well-placed lead. No one who has ever watched field-firing demonstrations by expert shots on a large scale will ever again babble about the needed fire-dispersion, the two-sights nonsense still promulgated in the American army. The fire of the most expert shots has enough dispersion to please the greatest of these two-sight advocates, while the fire of the average rank and file is lamentably wide in dispersion. The trouble is that these gentlemen have not had opportunity by dust-puffs to visualize just how much the fire of a battalion of skilled rifle shots scatters around the landscape.

[German Military Rifle Practice. *Scientific American*, Feb 3, '17. 3000 words. Illustrated.]

The British infantryman is a better marksman than the German. This fact was demonstrated by the British Army in France in 1914, when accurate rifle shooting and an efficient use of the small number of field guns saved the British from destruction by immensely superior forces. The main reasons for this distinction are the more accurate rear sight on the British rifle and the higher standard of workmanship required of the British soldier.

The German rear sight has a large "V," admits of no change in elevation of less than 100 yards, and has no wind gauge; whereas the British rear sight, with its fine change of elevation and its wind gauge, is adapted to fine shooting. The German course of rifle training is weak in its paucity of ammunition (about 100 rounds per man per year) and in its comparatively low standard of proficiency.

—Firing Regulations

Chile

[Our Firing Regulations. By Lt.-Col. Lara. *Memorial del Ejército de Chile*, Sept, '17. 4400 words.]

This article treats of modifications that are recommended in the firing regulations of the Chilean army, in order to simplify them, and to render them more applicable for instruction of the large percentage of uneducated men found in the annual classes of conscripts.

The firing regulations now in use, were translated literally from the firing regulations of the German army. No attempt was made to adapt the regulations to the use of soldiers of lower educational qualifications than those for whom they were written.

According to statistics there were only 2332 illiterates in the German contingent of conscripts of the year 1881, that is to say, 1.55 per cent. In the year 1891 there were only 824 illiterates, .45 per cent. In the year 1901 there were only 131 illiterates, or .05 per cent. In the year 1909 there were only 58 illiterates in the entire class called to the colors, and it is probable that in the class of 1911 not one single illiterate was found.

It is evident that the German firing regulations presuppose an educational standing among the conscripts that is far higher than that of the soldiers of Chile. The percentage of illiterates in the classes called to the colors annually in Chile is between 60 and 70 per cent; it is evident therefore, that modifications in the regulations are necessary.

—Instruction and Training

See also

GRENADES—GRENADIERS

INFANTRY—FIRE—INSTRUCTION AND TRAINING

[The Period Requisite for Training. *Army and Navy Jour.*, Jan 27, '17. 700 words.]

Major-General Leonard Wood, in his recommendations as to universal military training, favors a period of training with no minimum limit. He would authorize company, troop and battery commanders to recommend a man for transfer to the Reserve when, in the opinion of the officer, the man has become an efficient soldier.

In the British army, the average period of training has been fifteen months, altho men have been sent to the front after nine months' instruction.

[The Instruction of Noncommissioned Officers. Lecture by a British Officer in France. *Infantry Journal*, Feb, '17. 3300 words.]

THE ATTACK IN PHASES

The unit for instructional purposes is the platoon; the platoon commander will:

1. Explain what phase is going to be attempted and what the objects of this phase are. He will try to interest the men in the reason for everything they do.
2. He will cause demonstrations to be given to the platoon as suggested in the phases.
3. He will then, in most phases, hand the sections over to their commanders. The section commanders will then exercise their sections in the phase which has just been explained. The platoon commander will supervise them while they do so. The phases should first be dealt with separately, then in groups and finally all the phases of one subject attempted together.

PHASE I. ADVANCING IN EXTENDED ORDER

Faults to be avoided:

1. Men bunching together.
2. Loss of direction.
3. Men failing to see signals at once.

To illustrate:

Point 1. Ten men—Men who bunch attract fire to themselves.

2. Ten men—Loss of Direction means bunching in some places and gaps in others.

3. Ten men—Failing to watch for signals causes confusion and prevents those who did observe signal from executing order given.

Section commanders then exercise their sections in advancing and retiring in extended order, crossing paths, etc., which run diagonally to the line of advance. This tends to cause loss of direction.

Platoon and section commanders watch for faults.

PHASE 2. RUSHES

Four or five men demonstrate.

Points to which attention must be directed:

1. The man who gets up slowly is an easy target.
2. The man who gets up last is usually the last to get down and therefore draws most of the fire of the enemy.
3. The man who shifts about in order to be the better able to spring up, thereby gives notice to the enemy that he will soon be a target.

To illustrate these points, some of the men, giving demonstration rushes, should be caused to make the above mistakes and the results be explained.

Section commanders will then practice their men in rushing.

PHASE 3. MOVING TO A FLANK IN FILE WHEN EXTENDED —CROSSING A GAP IN FILE

Points to be specially noted:

1. Men must be shown that moving to a flank in file must never be attempted except under cover.

Demonstrate this by making men extended to three paces cross the front in file. Point out what an easy target they form.

2. Men must be taught how to cross a gap when moving in this formation. Make a wall with movable screen door or two or three men placed side by side to represent screen. Men move along the wall, the leading man halting short of the gap. Those in rear close up, placing themselves *on his flank,* not remaining behind him. When all are up, the word is given by the section commander and the section bolts across the gap.

Make six men go across individually and then return in rush as described.

Point out how single men present a far more lasting and favorable target.

PHASE 4. MOVING IN FILE AND THENCE WHEELING TO THE FRONT IN ORDER TO PASS THRU THE WOODS OR DEAD GROUND

1. Form the group in line.
2. Move to the right as in file (by the right flank).
3. Left wheel (change direction).
4. Without further orders, men close up on their leaders in file (double column of files).

Explain how in dead ground and woods, it is not rifle bullets (with flat trajectory) but shrapnel bullets with steep angle of descent which you fear.

Explain that, to avoid shells, it is best to get into small compact bodies, as shells are fired at an area of ground and not aimed at parties of men.

1. Explain that always, in woods and marshes—in file or single file:

1. Men move more quickly.
2. Keep direction better.
3. Are more under control of leader.
4. Can move by ditches.

Explain that when halted, men now kneel, as by lying down they must spread out.

PHASE 5. A PLATOON PASSING THRU A WOOD DURING AN ATTACK

1. The first line in each company goes thru the wood *extended* to clear wood of surprises.
2. The other lines, as soon as they get under cover of wood, wheel to a flank in file and wheel forward by sections as in phase 4.
3. As they enter the wood, the sections will feel in to each other sufficiently to be able to see each other in the wood (and no closer).

Thus the platoon (1) passes quickly thru the wood; (2) keeps under the hand of platoon commander; (3) sections can help each other if attacked; (4) platoon does not lose direction, and platoon commander (who alone probably has a compass) can march on a bearing and lead all his sections thereon.

INFANTRY—Continued

4. Before reaching the farther edge of the wood, sections must regain their original intervals.

5. Before breaking cover from the wood, the sections would extend, which they should practice by sections.

PHASE 6. BREAKING COVER

No man must show himself at edge of cover and thus give notice to enemy of presence of troops. To explain and demonstrate this, find suitable place. Show how much ground can be gained before enemy can direct fire on men.

Section should practice this, watched and criticized by their section leaders.

PHASE 7. REINFORCING

1. On signal to reinforce being given, the words "get ready for rapid," will be passed along the line by *whoever* sees the signal. Observers will look backwards.

N. B.—There should be one observer per platoon and perhaps per section.

2. Directly reinforcements appear, the observers and anyone else who sees reinforcements will shout "two rounds rapid."

3. Directly reinforcements throw themselves down in the line:

1. They will distribute ammunition.

2. And in return be told the range.

Whenever reinforcements arrive there must be this exchange.

PHASE 8. RETELLING OFF

1. As soon as, being reinforced, a line becomes mixed, it must be retold off into squads (avoid the word section, as it signifies one of the original commands in the company).

2. To do this the senior n. c. o. or soldier in each section of the original line or of the reinforcements tells off 10 or 12 men into his squad by calling out the names of those who are the flank of it. He will call it Corporal Brown's squad.

3. This is done all thru the line.

4. It is by no means an exact way of dividing a line.

5. Sections will sometimes overlap and often some men will not be told off at all. It is the duty of such men to attach themselves to the nearest formed squad.

6. It is far more important that such telling off should be rapid than that it should be accurate.

7. As soon as a squad is told off, it can advance; it should not wait until the whole line is told off.

8. By mixing up sections and retelling off, this most important operation can be practiced even in wet weather under cover.

PHASE 9. MUTUAL FIRE TO COVER RUSHES

This should be practiced by the four sections of a platoon together, tho it can be practiced in a platoon.

When it is no longer possible in an attack to advance without some of the attacking line keeping up fire, the following procedure will be followed (that of a platoon is shown for example):

1. Rushes will start from one flank, say the right.

2. Right section prepares to rush and passes this information along the line or sends some easily understood signal.

3. The next section to that which is going to advance will not be able to fire without danger to those rushing, so the men of it lie flat with heads down.

4. The remaining sections prepare to fire and the instant the rush is commenced, give two rounds of rapid fire to keep down the heads of the enemy.

5. The rushes should start from both flanks and perhaps from the center as well of the company, sections following one after the other.

6. The following important points must be taught by repeating if necessary:

The closer you are to the enemy, the shorter must be the rush, more men rushing at a time.

PHASE 10. PASSING MESSAGES

1. Men must be taught to pass messages in short concise sentences.

2. The name of the sender must be given at the beginning and end of each message. No more noise than necessary should be made.

3. If the name of the sender is not given, the message must never be passed.

4. This most important duty can be taught in the barrack room along a line of men lying or standing.

PHASE 11. FIXING BAYONETS

1. If an attack starts from within 600 yards of the enemy, bayonets should be fixed before commencing.

2. If bayonets are not fixed before the attack develops, this should be done at a range of from 300 to 400 yards.

3. Front rank men should fix while rear rank men fire, then positions are reversed.

4. Men should be taught to fix bayonets when prone without unnecessary movement of the body, which might draw fire.

PHASE 12. THE CHARGE

1. Men should be formed up almost shoulder to shoulder.

2. They should deliver two rounds rapid fire as a preliminary.

3. The charge should be slow and strong (no faster than the pace of the slowest man).

4. The men should keep as good a line as possible.

5. Men should be shown by demonstration that a slow and steady advance looks far more alarming and irresistible than a disorganized scrambling mob.

6. Troops should never charge a greater distance than 50 yards.

PHASE 13. THE PURSUIT

After the men have been taught to charge, they can be taught the pursuit.

To do this they should charge pole-targets or men in distinctive dress representing the enemy. These will then retire.

The men charging throw themselves down and fire rapidly at the enemy.

The men will be taught the objections to pursuit with the bayonet, so dear to the unthinking soldier. They are:

1. The enemy are fresh, whereas the attackers are tired, so that pursuit with the bayonet is usually ineffective. "You can't catch them."

2. The enemy's artillery will shell the taken position, while the artillery supporting the attack will follow the flying foe with fire. So that the only safe place for troops, who have taken trenches, is in them.

Troops will be reformed and ammunition equalized and distributed.

If enemy disappear, scouts keeps in touch with them.

PHASE 14. REFORMING AFTER THE CAPTURE OF POSITION

If artillery fire does not prevent it, the platoon which came into battle last pushes on to reform in extended order, prepared for instant resistance to attack.

The remaining platoons reform behind the taken position if there should be cover available there.

This should be done by the senior officer, n.c.o., or soldier in each platoon facing the front and holding up his arm or rifle.

The men will rally on him, facing the same way, in single rank in column of sections. They will kneel or lie down as cover demands.

The following should be taught to the men and the reasons for them explained:

1. Whenever troops break cover, they should run at *top* speed until stopped by fire.

If the troops have not shown themselves before breaking cover, they should be able to pass some ground before being detected.

It should take the enemy several seconds to direct fire on to them when detected. Thus ground is gained without firing a shot. The greatest fear of attackers is exhaustion of ammunition.

Thus to gain ground in this way without firing is of great value.

2. Once troops have commenced to attack, the faster they advance the safer they are.

The more quickly they cover the ground to the enemy's position, the shorter the time during which they are exposed to fire. The faster the advance, the greater the difficulty of the hostile artillery in keeping the range of the attackers.

If their advance is rapid, the enemy loses confidence and consequently his accuracy of aim.

3. The object of an attack is to reach a position from which the enemy's rifle and machine-gun fire can be beaten down. (This range is sometimes as short as 50 yards.)

Unless the attackers have immensely larger numbers, they cannot charge infantry who continue to fire accurately and rapidly. This the Germans continue to disregard.

4. Until this position is reached, not a shot should be fired except:

1. To aid movement of own troops.

2. To repel some exceptionally dangerous target (a counter-attack, etc.).

Exhaustion of ammunition is the greatest fear of the attackers. It is *only* by fire at the closest range that fire superiority will be won. Therefore not a shot more than is absolutely necessary should be fired until this range is reached.

5. At a longer range, rushes should be longer, one section rushing at a time. (Rushes of 30 yards at 800 yards.)

It takes the enemy some time to "pick up" and fire at the longer range.

They are apt to "brown"* parties of men and not to aim at individuals. Therefore the number of men rushing at a time should not be large.

6. The closer the range, the shorter the rush, but the more men engaged in it. (At 300 yards, a rush of two sections for 15 yards.)

At closer ranges, the enemy can snap quickly; therefore the exposure of men must be for a very short time. At closer ranges, the enemy will aim at individual men; therefore the more men up at once, the more confusing to the enemy. The more men who rush together, the greater their confidence.

7. To prevent exhaustion of ammunition, never give covering fire unless the rush it aids is unable to move without it.

A DRILL ATTACK BY A COMPANY TO TEACH PLATOON COMMANDERS THEIR DUTY

To make a drill attack with a company, the following suggestions may be followed:

A pole-target enemy is used—flags or men.

Leading platoon in formation as in phase 1 breaks cover as in phase 6 and advances some 200 yards.

Platoon commander is told he is held up by fire.

He signals for reinforcements as in phase 7.

The second platoon, which has had a lookout watching for this signal, breaks cover as in phase 6 and advances (phase 2): reinforces first platoon as in phase 7.

The line re-tells off as in phase 8.

The line advances 100 yards or so as in phase 9.

The line is told it cannot advance farther till reinforced.

The signal is given and the third line reinforces.

The line re-tells off and advances as in phase 9.

It is told it cannot advance farther and signals for reinforcements.

The fourth platoon reinforces: line re-tells off.

The line advances to within 50 yards of enemy.

The line charges (phase 12).

The pole-targets representing enemy are retired by the men controlling them.

The line pursues with fire (phase 13).

The scouts are sent out.

The line reforms (phase 14).

Before a drill attack by a company is made, platoons must be trained in and be able to perform all the phases separately and collectively.

*"Brown" signifies a kind of concentration on a party.

[Annual Course of Instruction. By Capt. Agustin Cremades Sunol. *Mem. de Infanteria,* Apr, '17. 5000 words.]

All instruction should have for its end preparation for service in war. Troops in campaign are either on the march, at rest, or in combat, and peace instruction should be directed to the various phases of these situations.

INFANTRY—Continued

Particular attention should be paid to developing the initiative of subordinate commanders. This is accomplished in time of peace by practical exercises which accustom subordinates to meet tactical situations without definite and detailed orders of superiors. As succession in command is frequent in war, subordinates should be given opportunity to practice the duties of the next higher command.

Physical exercises.—Service in war entails great physical hardship; to meet it satisfactorily requires agility, vigor, and resistance to fatigue, and physical training should include exercises in respiration, flexion, and muscular co-ordination.

Tactical Instruction.—The methods of action of infantry in combat are fire, evolution, and maneuver, and the training of the troops should be directed to developing the greatest skill in the use of the rifle and bayonet, and flexible formations for approaching the enemy and delivering the assault.

Close order drills are valuable as a means of inculcating discipline and teaching order and cohesion, but routine drills on the parade ground are tiresome and uninteresting and the same purpose will be served by exercises on varied terrain having a tactical object in view. Before taking up the combat exercises the company should be trained in the mechanism of open order, the advance by echelons and rushes, the reinforcement of the firing line and the assembly.

Combat Exercises.—The tactical aptitude of the officers should be developed by exercises on the map and on the terrain. This instruction should be progressive; advancing from simple situations on the map to complex exercises involving the actual use of troops on both sides.

For these exercises the company should frequently be built up to war strength. The exercise should always be followed by a critique, in which attention is called to errors and suggestions made for future guidance.

In the combat exercises every effort should be made to develop the skill and initiative of the troops, and the action of each individual should have a definite tactical object in view.

During the combat it is necessary to maintain communication with adjacent units and the next higher commander; this service requires specially trained men and adequate materiél, and must be constantly practiced in time of peace to secure satisfactory results in battle.

Reconnaissance must also be continued during the combat to protect our own forces from surprise, to maintain connection with lateral units, to cover exposed flanks, and to scout to the front during pauses in the fight. Here again trained men are needed who should be instructed in methods of orientation, knowledge of terrain, estimation of distances, and appreciation of objectives, and this service must be practiced in varied terrain and under assumed tactical conditions.

In the advance under fire, advantage must be taken of all features of the terrain to save our own troops and to secure an advantage over the enemy. This requires judgment and technical knowledge on the part of all, which is acquired only by frequent exercises specially directed to the utilization of the terrain.

Machine Guns.—The special attribute of the machine gun being fire effectiveness, the training should seek to develop accuracy in shooting and skill in the handling of the gun. The personnel should be practiced in selecting positions of fire, use and construction of cover, and changing position when under fire.

Instruction in Fire.—This includes the technical training of the individual soldier and the application of fire in combat.

The training of the soldier to shoot is an individual problem to be worked out in the case of each man. Effort should be stimulated by criticism, rewards, etc. The soldier should be taught to shoot in battle as he would hunt, and not with the vague idea of "attacking a place." For combat fire, the troops should be practiced over varied terrain, using blank ammunition, advancing against an outlined enemy and against an opposing force.

Special attention should be given to keeping up the supply of ammunition, the position and movement of the ammunition wagons thruout the combat and forwarding ammunition to the firing line.

Preparation of sanitary troops includes practice by individuals of their special missions and exercises in arranging and locating sanitary formations under assumed tactical situations in the field.

Field Service.—This should include practice marches for hardening the soldier, and such marches should always have a tactical object, the company acting as advance, flank or rear guard, or with a special mission. Exercises should also be had in loading and detraining for movement by rail.

Overnight halts should be made in villages or camps and the service of security carried out in every detail.

Field Fortifications.—Instruction of officers should be by map problem or terrain exercise, and consist in determining the character of works to be constructed and their location under assumed tactical conditions.

The troops should be trained in the actual preparation of such works as can be constructed without special tools, including points of support for offensive or defensive action, and the hasty shelters improvised with the means found at hand when advancing under fire.

Instruction should also be given in the construction of kitchens, latrines and bivouac shelters.

[Specialization *in Extremis*. *Army & Navy Gazette*, July 14, '17. 500 words.]

There has been much specialization in the military art. At one time this threatened to interfere with the proper general training of the troops thru the number removed for special training. But we (British) did not go to extremes and the specialists were for the most part left with their battalions and thus spread their newly-acquired knowledge.

The Germans have gone to extremes in the formation of *Stosstruppen*, or "shock troops," by gathering

the best fighters,—men of youth, daring, and vigor,—into these special organizations. These are the men who make counter-attacks. They sometimes succeed, but the heavy losses are from the flower of the army, and the positions may possibly be lost by the inferior troops who replace these special units. When specialization is carried too far it promotes the decline of general quality.

[Editorial Department, Training and Discipline. *Infantry Jour.*, Aug, '17. 1200 words.]

There are two phases in the training of all arms—instruction in the mechanical or technical duties of the arm, and the imparting of disciplne. It takes much longer to impart discipline than it does to impart training in technical duties. The offensive requires better training and discipline than the defensive. In the final analysis, the result on the offensive or defensive depends upon the infantry. Therefore infantry must have the hardest, most intensive, and longest training of all arms.

By discipline is meant not merely mechanical obedience to rules and regulations, but that higher quality which insures cohesion and control of units under the most trying ordeals.

Loss of cohesion and control of partially trained infantry cost the British dearly at Neuve Chapelle. Enthusiasm and patriotism carried the new British levies over and thru the advanced German trenches, but lack of cohesion and control caused them to be ejected from the captured positions and then thrown back three or four miles from the line originally held, all this with heavy loss. Loos was another example of an attack skillfully planned which came to nought with a loss of 60,000 due to lack of discipline, initiative, cohesion, and control. Yet these men had had a minimum of nine months' training, and most of them had had a year or more. Individual courage is not enough. This the British troops had, but they lacked the necessary training.

Any scheme of training based upon the principle that it takes less time to train infantry than other arms will lead eventually to a Neuve Chapelle or a Loos.

[Varied Ground. Notes to Assist Company Officers in Preparing Lectures for the Training of Recruits. *Infantry Jour.*, Aug, '17. 2500 words.]

(Suggestions are made of the principal points to be covered under each of the following heads and subheads.)

Drill, Musketry, Discipline, Crimes, and Punishments—Drill—Musketry—Care of arms—Aiming and firing instruction—Reasons for a normal sight—Judging distance—Theory (interior and exterior ballistics of rifle)—Types of fire—Visual training (seeing and not being seen)— Military vocabulary — Discipline — Saluting—Crime and punishments.

Interior Economy, Pay and Messing—Daily rates of pay — Stoppages — Method of payment — Messing — Clothing—Duties (daily routine)—Duties on guard.

Active Service, Trench Warfare, Protection, Hygiene—Conduct on active service—Conduct in billets—Trench warfare—Bombing—Protection—Hygiene and sanitation—First field dressing.

Outline of Lectures on Anti-Gas Measures to Be Given to Recruits in the First Fortnight of Training—Cloud or cylinder gas—Gas shells (tear-shells or "lachrymatory shells")—Gas shells (poison gas shells)—Protection—Flammenwerfer (flame throwers).

[Training in Morale. By Capt. Allan L. Briggs, 3d Infantry. *Infantry Jour.*, Oct, '17. 1500 words.]

The standard of instruction in the armies of the Allies is recognized by all, from generals to men of the latest draft, as expressed by an officer of the British General Staff—"If you don't know, you get killed."

Eagerness and intensity, such as we witness in sports, is shown in the work of the men in the training camps abroad. Every drill and exercise is full of snap. Our officers must realize this importance of speed and smartness in drills, and set the men a proper example. The American possesses that quality, which athletes call "spring," which will enable him to best the German in all offensive work, if his "spring" is developed by fast and smooth drills.

Another standard fixed by the intensity of the war is, "Having reached an objective, never retire." The moral and tactical advantages of this decision keep you fighting, and often help you to hold your ground until support arrives. Men sent forward are considered tactically expended when they reach their objective. Succeeding elements furnish the decisive factor.

The unauthorized absence of any man while his command is in the front line is punished as desertion. The men understand this and no leniency is shown offenders. Instruction in grenades and trench mortars is with live ammunition; dangerous work, but ignorance is more dangerous. All the old ideas for the making of discipline are upheld, and their true values are now being recognized by the colonial troops.

There are now established in France for the British troops five Base Schools, and a group of Army Schools for each of the five British armies. The Base Schools receive the new drafts; have a capacity of about 10,000 men; and give a brief nine days' course in musketry, grenade and bayonet work, gas and trench relief, wiring, intrenching and other essentials for front line work. The course is rather a test for efficiency, only those who qualify are sent to the front. The Army Schools train company officers and non-commissioned officers in specialties, fitting them to become instructors in divisional schools and for their own men. These schools serve to encourage *esprit de l'armée,* afford an opportunity for the exchange of ideas, and to impress upon all the necessity for everyone to do his utmost.

The soldier must have a leader for his soul as well as for his body. His captain must furnish him with such an example of courage, patriotism, cheerfulness under suffering, and devotion to duty as will help him to build his character to that height where every soldier stands ready to give his life to remain the captain of his soul.

INFANTRY—Continued

Argentina

[The Question of the Hour. By Captain Aicrag. *Rev. del Circulo Militar*, Feb, '17. 2500 words.]

For some time articles have been appearing in our military journals favoring a reduction of the period of service for our conscripts from a year to six months.

The arguments usually presented are as follows:

(*a*) At equal expense double the number of recruits could be passed thru the ranks.

(*b*) That six months is sufficient for preparation for service in the field.

(*c*) That by giving military instruction in the primary and secondary schools, the training could be completed in six months with the colors.

It is time to give up speculation on this subject and come down to facts. To be efficient in battle, the infantry soldier must be a good shot and skilled in the use of the bayonet. He must understand the duties of a sentinel, patrol and scout and know how to construct a trench. He must be able to execute the close order movements with precision and the open order to the smallest details which concern the soldier. He must understand the use of the first aid packet and the rules of hygiene, must have a clear conception of the laws of war, and his military spirit must be so firmly established that the fear of death will not make him falter.

When we stop to consider that approximately 60 per cent of our conscripts are illiterates, the impossibility of preparing them in all these subjects in six months must be apparent.

It is true that we might by reducing the service to six months put twice the numbers thru the ranks, but would it not be better for us to have five well trained divisions than ten divisions only half instructed?

Von Bernhardi says "Large armies without a solid basis of military training only serve to make trouble on the battle field."

To obtain the best results under the present conditions, we should incorporate twenty thousand conscripts in the ranks each year. Five or six months should be devoted to individual (recruit) instruction, four or five months to the company, and the periods of battalion, regimental and brigade instruction should be as at present.

Regional maneuvers should be held for twelve days each year, and grand maneuvers for a period of fifteen days every second year. Those freed from service the preceding year should be called for a month during the grand maneuvers.

Chile

[Time Required for the Instruction of Infantry. By Capt. Bartolomé Descalzo. *Rev. del Circulo Militar*, Mar, '17. 2500 words.]

In an earlier number of the *Revista* it was asserted that six months of preparation in peace was sufficient to prepare a citizen for infantry service in war, and it was pointed out that this was being accomplished in England at the present time.

It is easy for the professional soldier to understand that in the excitement and enthusiasm of a war much more can be accomplished in six months of training than in an equal period of time during peace. Under such conditions only those things absolutely necessary for service in war are taught, and instruction is greatly facilitated by the eagerness of the men to fit themselves for the duties of a soldier.

The purpose of military training is to prepare the man for service in war, but this fact appears to have been lost sight of with us at the present time, and existing laws require that the recruit shall be instructed in elementary school subjects and many other things in addition to the purely military duties of a soldier. This instruction takes up a great part of the time and when we consider the time lost in holidays, parades, sanitary inspections, etc., the captain will be fortunate who can figure out from the four months allotted for recruit instruction three months of working days. This leaves only two months for the rest of the program; school of the company, battalion, regiment, and the maneuvers.

The impossibilty of properly preparing the infantry soldier in this limited time must be apparent to anyone who will seriously consider the detailed course of instruction required by the regulations.

Officers serving with troops know that the program worked out on a basis of six months' training is purely theoretical and that the conscripts are only half instructed.

A year is the very least we should ask in our army to prepare the citizens for the duties of a soldier, and a second year is necessary to prepare those who are to exercise small command.

United States

[Training the New Forces. *Army & Navy Jour.*, Oct 13, '17. 450 words.]

A schedule of concentrated progressive training covering sixteen weeks has been prescribed for the divisions in training in this country. The instruction includes individual, squad, platoon and company drill, with short periods of battalion instruction in the fifteenth and sixteenth weeks. Forty working hours per week are required. Wednesday and Saturday afternoons are free for recreation or for the drilling of backward men. This training period of sixteen weeks has been determined as the minimum required before troops may be sent abroad. Progressive training of regiments, brigades and divisions will be pursued at the end of the sixteen weeks. Great stress is laid upon the necessity for target practice and night training. Trench raiding, scouting and trench construction will be illustrated in night drills. Division commanders have been instructed to require the men of their commands to spend every available hour upon the target range, and to complete as far as practicable target practice before embarkation for France.

—Marching

See

MARCHES AND MARCHING

—Motor Transport of

[Trial Movement of Infantry by Motor. By Lt.-Col. C. H. Martin, 18th Inf., U. S. Army. *Power Wagon*, June, '17. 3000 words.]

(An account in some detail of a movement from Douglas, Ariz., to Roosevelt Dam and return, a distance of 665 miles. Two battalions started. One had to return; the other made the full trip. 1½-ton trucks were used, each carrying two squads, chauffeur and one extra. The average daily distance was 66.5 miles; maximum 112 miles; average speed on the road, 8 miles per hour. Roads, very poor.)

—Organization

United States

[Note. *Army & Navy Journal*, Sept 1, '17. 200 words.]

The total strength of an infantry regiment, under the new organization is 95 officers and 3604 men. This includes a machine gun company and a bombing company. Each state adjusts its own National Guard army units to meet the new conditions. Organizations depleted by this method will be filled up by draft troops.

—Protection for

See also

HELMETS—ARMORED

—Tactics

See also

GRENADES (Article: "'Marines Manual' Department")

PATROLS

RAIDS—TRENCH

—Tactics—Attack

See also

INFANTRY—TACTICS—COMBAT

[Notes on Infantry. Translated from Spanish by P. S. *Revista Militar* (Portugal), Mar, '17. 1700 words.]

Methods of Attack Employed by German Infantry.

The divisions of each corps are posted side by side, and each division furnishes its own supports and reserves. The brigade consists of three infantry regiments, 7200 bayonets, covering a front of 1000 to 2500 meters, depending upon the object to be accomplished. Two regiments side by side form the first line, with the third regiment in reserve. The nature of the terrain and the object to be attained may, however, permit the employment of all three regiments in the first line.

Whatever the disposition of the division, each regiment has one battalion in the first line, one in support, and one in reserve.

In the attack, the first line battalion is divided into two parts of two companies each. The two companies that initiate the attack constitute the first wave. Each wave has a well defined objective which is limited to the front of the attacking wave. The attack is not launched until the artillery has completely destroyed all obstacles and reduced resistance to a minimum. The first wave of the attack is in reality a reconnaissance, and the second wave is not launched until the first wave has attained its objective.

The successive waves are sent forward with a distance of 20 to 30 paces. The first wave is a thin line, while the second is dense and is intended to occupy the captured trenches. They take the tools, sand bags, etc., necessary for organizing the trenches.

Contrary to the general impression, the Germans do not use small columns in rear of the first wave. They use only line formation for the attack.

[Reinforcement in the Offensive Combat of Infantry. By Col. Navarrete. *Memorial del Ejército de Chile*, June, '17. 10,000 words.]

(A study of the offensive combat of infantry. The writer bases this study upon the most recent teachings of the war, experience at maneuvers, and the principles of the French and other foreign regulations. His idea is to present a simple and rational concept of the use and economy of reinforcements.

The article has seven chapters headed as follows:

(1) Role of reinforcements.
(2) Partition of the reinforcements.
(3) March of the reinforcements.
(4) Use of reinforcements.
(5) Execution of the reinforcement.
(6) Reinforcements at the moment of assault.
(7) Reinforcements in the decisive attack.)

—Tactics—Combat

[A Study of the Infantry Advance in Combat. By Majors José Fernández Macapinlac and Enrique Maquieira, Spanish Army. *Memorial de Infantería* (Spain), Feb, '17. 10,000 words.]

A fighting man must possess certain well-known moral and material qualifications, and the disappearance of any of these qualities is always accompanied by certain other outer changes. Thus, when man first began to lose confidence in his personal, physical mastery over the earth, he at once began to seek some weapon which would compensate for his own weakening forces, and as this weapon was perfected, man's prowess decreased until finally he was no longer absolute master of his actions, and instead of roaming the world at large he chose to become a unit in some group of his own kind, the group or tribe being ruled by one strong-minded man. So, in the study of arms, the first paradox which presents itself is that the individual ceases to depend on himself and gives implicit trust and obedience to some other man who, in turn, must dominate his own weakness and lack of self-control in order that he may be worthy of the trust imposed in him by his followers. This idea once established, the phalanx and cohort became the military creed—a huge mass and a brutal shock, all directed by one man. The idea of physical shock was of great importance, and to further it war machinery was devised. The use of this tended still more to decrease the soldier's dependence on his personal fighting ability, for he soon learned to hide whenever possible in order to escape injury. In this way fortification and the defensive were born, and in the great war of to-day we have all of these inherited precepts of the military art, and have added to them the element of rapidity, both in shifting heavy fire action and in transporting large bodies of troops.

The rôle of the infantry man is one of ever-increas-

INFANTRY—Continued

ing importance and difficulties, for the hostile artillery fire will allow him only one protection while advancing, that of not being seen. The attacking troops will remain in masses as long as possible, hiding their advance by carefully selected terrain, but upon entering the zone of effective hostile fire the selection of the route to be followed, the method ot advance, etc., become of the greatest importance. However, the best led troops will have to pass over open spaces, unprotected save by their own artillery. In each particular case the most effective means to the end must be sought. In the opening phases of the attack there need be no hesitancy in thinning out the troops and in using the slow method of infiltration [by this term the authors mean advancing by very thin successive lines or groups, or even individually.—ED.], for this in itself will often deceive the enemy. In this method care must be taken that the infantry never gets itself into such a position that it can be struck without returning the blow. At other times dangerous ground must be crossed at all costs and at a time, too, when it would be a grievous fault to employ the tedious advance of man by man or by small fractions. In such cases the element of rapidity enters, and the quickest method of crossing becomes of prime importance, remembering, of course, that the risk run must be in direct proportion to the tactical advantages or necessities.

From the moment the enemy's fire become effective, the advance must become an attack in which the problem for the leaders is to maintain the direction and control of their units under the suddenly changed conditions of the advance.

Since the assault is the necessary end of the attack, it follows that every movement of the advance must tend to prepare for the supreme moment of assault. This idea of aggressiveness is so foreign to the idea of infiltration that the one hardly supports the other. The latter system, with its undue dispersion, which weakens the power of all units and does not allow rapidity of movement, is not recommended. It does not give to the command the moral strength so necessary on the battlefield, for it often deprives the soldier of the immediate presence of his leaders, and this perhaps at critical moments.

The answer to all of this is, of course, that the system possesses great economy in men, and without it the troops would remain at some half-way point, unable to advance. It costs time, but is worth it, because it is sure, and is the only possible way of advancing without ruinous losses. True; but the offensive will always cost men, and the desire of avoiding casualties must never be greater than that of accomplishing the mission. Besides, infantry losses will not always be as great as expected, for it does not fight alone, and at the most critical moments of combat it will receive the greatest aid from the artillery. But the artillery fire can only help, and for a successful attack we must have vigorous, constant artillery operating in conjunction with an infantry well trained, intelligently led and possessing great maneuvering elasticity.

The filiform method of advance is objected to not only because it is often too slow, but because its use tends to minimize the offensive spirit of the infantry. Great stress is laid on infantry fire superiority and artillery support, and the offensive should always move rapidly toward the enemy.

Infiltration will often be resorted to, but it must be secondary to the idea of the rapid forward movement, the soldier being taught quickly to discover his individual target or objective in the general line allotted to his unit. The important element of rapidity must be carefully used and conserved in order that the final shock may be effective, for infantry in the attack must be an avalanche, and this idea does not admit of infiltration.

[Organization of the Infantry Battalion. New Armament and Tactics. From Authoritative Sources. *Infantry Jour.*, June, '17. 4000 words. 5 diagrams and 1 table.]

The great modifications in the armament, organization and tactics now used in the French army, are herein described.

The weapons in the infantry armament are: The Chauchat light automatic machine rifle, weighing 18 pounds; the Viven-Bessières rifle grenade, fired from the ordinary rifle fitted with a special tromblon or blunderbuss attachment, using the service ball cartridge; hand grenades, defensive and offensive types; the 37 mm. cannon; and in the trenches, low powered trench weapons, some of them pneumatic.

Much greater importance is taken by machine guns, automatic machine rifles and grenades. Each infantry company is composed of 32 hand grenadiers; 24 rifle grenadiers; 24 fusiliers, who serve eight automatic machine rifles; the remaining half, voltigeurs or riflemen, who are trained to take the places of the specialists when necessity arises.

CHARACTERISTICS OF THE NEW ARMS

Hand grenades: These are of two types, defensive and offensive. In defense, the grenadiers establish a barrage at 25 meters which is very difficult to overcome. In the attack, they are used against an entrenched enemy at close ranges, their mission being to break up localized resistances. They are chosen soldiers, carefully trained, their accuracy and discipline being of utmost importance.

Rifle grenades: 16 tromblons per company throw 150 grenades a minute, producing an impassable barrage 80 to 150 meters deep along the company front. The grenade is deadly, and particularly valuable in the offensive—in the preparation for the assault, and later on, in making a defensive barrage against counter attacks.

Each battalion of three companies starts the attack with a minimum of 2000 hand grenades, and 1500 rifle grenades (sufficient for two minutes fire). Hence suitable organization must exist for sending forward new supplies when the objective is reached.

Automatic Machine Rifle: Its chief characteristics are: great mobility with personnel of three men; great efficacy at short ranges; possibility of firing from the hip while advancing. It is not capable of the long sustained fire of the machine gun.

Machine guns: One company of the battalion is specialized in the service of machine guns, eight guns being provided. In most cases they are employed in fixed emplacements which flank the approaches of a position.

37 mm. cannon: This is an extremely accurate gun, useful up to 1500 meters. The bursting effect is equal to that of a grenade, and in addition it has sufficient striking energy to penetrate several sand bags or a thin steel shield before bursting. It is a rapid-fire, split trail piece, mounted on wheels, and able to accompany infantry in all stages of combat. It affords a good target, hence is employed separately instead of in batteries, and is used only in the last few minutes preceding an assault, being directed against visible machine gun emplacements.

Summing up the characteristics of the new arms:

1. The machine guns greatly increase the defensive capacity of the battalion.
2. The 37 mm. cannon is a powerful offensive weapon against machine guns.
3. Barrages set up by automatic machine rifles and grenades enable the infantry to hold ground when artillery support is lacking.
4. In attack, the grenadiers and fusiliers break up local resistances in preparation for the riflemen following.
5. The employment of all these weapons keeps the enemy crouched in his trench while the grenadiers and fusiliers advance to the attack.

THE COMPANY ORGANIZATION

The company is divided into four sections, each section composed of:

(a) One half-section of specialists consisting of one chief and two squads. The first squad consists of a corporal, seven grenadiers with hand grenades, and four riflemen. The second squad consists of a corporal and six fusiliers, the personnel of two automatic machine rifles.

(b) One-half-section of riflemen, consisting also of two squads and including four men armed with tromblon Viven-Bessières, and two rifle grenade bearers.

This arrangement permits the use of the new arms without upsetting the existing infantry organization.

COMBAT FORMATION

Offensive

The greatest change effected is the formation of the first waves or lines of men at four or five paces interval, which is far less vulnerable than the dense lines hitherto employed.

Section: The assaulting and the support sections each move in two waves, four or five pace intervals. The first wave consists of grenadiers and fusiliers, and the second of riflemen and rifle grenadiers.

The first wave of the support consists of the half-section of specialists who are the first called to reinforce the assaulting sections.

When the objective is reached the specialists clear out the trenches, shell holes, etc., and the riflemen organize the position.

Company: The attacking front varies from 200 to 300 meters. Two or three sections are placed in the assaulting line, with one or two in support, the captain walking between.

The attack may take the nature of an assault or of a progression. In the assault, a complete hostile area is taken in a single dash, the hostile trenches passed over being cleaned out by special fractions composed chiefly of grenadiers, who closely follow the assaulting sections.

In the progression, the unit taking a point, immediately cleans it out and organizes it.

Battalion: In this example, the battalion has certain trenches as its first objectives and must then progress to a second objective, both of which are designated accurately on the map. The chief of the battalion counts on reaching the first objective in the first dash but makes provision for forcing the resistance should it prove necessary.

The orders of the chief prescribe:

(a) Disposition of his forces, namely: Two companies in the first line. Support, one-half company of machine guns. One company. One-half company machine guns with the 37 mm. cannon.

(b) The orders for the front line, including: the objective of each company; the zone of march of each company; the maneuver in case of resistance at the first objective; the dispositions upon arrival there, including the reconnaissance forward by specialists to the limit of French artillery barrage.

(c) The points to be obtained successively by units which the chief has kept in his own hands (machine guns, supporting company); routes they must follow; the formation of the supporting company.

(d) The mission assigned to the rear half-machine gun company and to the 37 mm. cannon, which remains near the trench of departure covering the advance; the route in detail that the cannon will afterward follow.

(e) Precise plans for trench cleaning.

(f) The route the chief of the battalion will follow.

(g) Arrangement for co-operation with the aviators and the artillery.

(h) Arrangements for replenishment of ammunition and for the evacuation; the communications which the pioneers re-establish immediately.

The details are complicated, but before the action, each individual understands the part he is to play, and the commander of each fraction has a detailed sketch showing the alloted tasks.

DEFENSES

There is always one line upon which the most vigorous resistance must be made. The most formidable defensive weapon is the machine gun delivering flanking fire. The automatic machine rifle may also be used for this service tho it is inferior to the machine gun. The guns used for flanking fire must be covered by grenadiers.

The remaining automatic machine rifles, the hand and the rifle grenades are used to produce barrages,

INFANTRY—Continued

and the riflemen and grenadiers who are unemployed are reserved for counter attacking.

The companies of the second line are so disposed that their weapons can effectively cover the whole front line should it be invaded. After a short fire preparation, riflemen and grenadiers counter attack.

In conclusion, the new armament has increased the offensive and defensive power of the battalion, but the weapons are valuable only in the hands of disciplined and instructed troops, directed by officers having precise knowledge of their proper employment.

—Tactics—Co-operation with Artillery

[Revolutionizing Warfare. *Army & Navy Jour.*, Apr 24, '17. Quoted.]

The German decision to withdraw without fighting before the terrific British bombardment on the Ancre River is a repetition of what took place before Verdun, when the enemy evacuated Fort Vaux without waiting for the French infantry assault, and illustrates anew the prominent rôle artillery has assumed in recent warfare. Scientific and industrial attainments have more to do with success than the worth of the human element; a comprehensive revolution, indeed, that makes it an obligation for military students to relearn the art of war. The combat, formerly a shock between two human masses in which leadership, maneuvering, bravery, determined the issue, has come to depend upon the result of an artillery duel in which that side is assured of victory which can, in a given time, pour over the enemy the greater weight of steel and explosives.

It would, of course, be exaggeration to contend that time-honored soldierly qualities have become of no account; the way French infantry before Verdun withstood the frightful shelling of thousands of German guns tells otherwise; but still what can the most heroic infantry do in positions reduced to shapeless heaps and every second raked by monster shells, digging huge craters and disseminating far and wide splinters and asphyxiating gases?

The rôle of infantry remains, of course, of vital moment, and it will leap anew to the first place whenever siege warfare makes room for mobile warfare which, it is expected, will mark the final stage of the conflict. France has lost no time in adapting her infantry to the new conditions of warfare. Up to 1915, a French company included 250 men uniformly armed with the excellent Lebel rifle and its peculiar and formidable bayonet, whereas to-day it comprises three distinct classes of soldiers, intended for special tasks, namely, grenadiers, selected for their robustness and agility, and trained in the handling and throwing of hand grenades at distances of twenty-five to forty meters; "fusiliers - mitrailleurs," selected mostly for their sang-froid, and armed with the new quick-firing automatic rifle; and lastly, in greater number, "voltigeurs," with the usual Lebel rifle. At the moment of the attack against enemy positions, previously submitted to intense artillery bombardment, the company is thrown forward in a series of successive "waves" (vagues d'assaut), the first comprising in majority grenadiers, whose skilfully thrown grenades with curved trajectory fall obliquely or vertically on the defenders hidden in holes or behind parapets. Moreover, experience has led to the assignment to each infantry battalion of an increasing number of machine guns and one-pounders.

It is obvious that infantry training is ever becoming more complicated and more difficult, and that infantry efficiency in action requires on the part of the men much greater discipline, professional ability and sang-froid than before. Happily, natural dash and enthusiasm do not exclude those essential military qualities.

[Liaison Between Artillery and Infantry in Offense. By Capt. E. B. Tarduchy. *Memorial de Infanteria*, June, '17. 10,500 words.]

Combat is the most powerful means of destroying the enemy, which is the principal object of warfare. Success in combat cannot be gained without having all forces under one command, and a single desire in every heart. There must be perfect liaison between the various branches of the service, and within these branches themselves, before a single man can command an army, or a single desire can be universally felt in the ranks.

The two methods of warfare are attack and defense. It may be said that defensive warfare is the best, because the defender can make the best use of his artillery, and afford the best protection for his infantry, but to obtain decisive results in warfare the attack is superior to the defense. Attack implies an infantry advance in the face of every conceivable weapon of destruction. The artillery protects the infantry in its advance, as advancing infantry is practically incapable of producing effective rifle fire. It also assures the infantry's chance of success. To successfully use both arms a technical and moral liaison between them is necessary. Their action must be reciprocal and inseparable.

"High and Low Liaison"

"High liaison" is the indication, by the commander-in-chief, of the objectives of both arms. "Low liaison" is the uninterrupted communication between the executive commanders. "High liaison" affects the direction of an operation, while "low liaison" is a means of its execution. The former includes all information, orders, or notices from the commanding officers of troops to the artillery commander, and vice versa. The latter includes the details of co-operation between the two arms. These details are dependent upon the infantry action and change with its development. The higher commanders should not be bothered with them.

In "high liaison," artillery regulations try to block every attempt of a commander in handling troops of an arm to which he does not belong. In the original disposition of forces, the French commander-in-chief cannot locate his artillery—this being left to the artillery commander. In the German army, the commander-in-chief does place the artillery, after consulting with the artillery commander, as the first infantry lines depend upon the position of the artillery.

The general plan of action, its development and modification, as well as its general progress, should be known to all the higher commanders of infantry and artillery, and should be transmitted by them to subordinates.

Material Liaison

The artillery should always have an authorized agent of communication, near the general who directs the battle; and there should be constant telephonic communication from this agent to battery commanders. The telephone presents a great many difficulties when used on the battlefield. These are chiefly due to the necessary wires. In permanent fortifications, or in trench warfare, these difficulties are lessened. Visual signals, when simple and not too numerous, may be used; but they must be thoroly learned and carefully transmitted.

The artillery should always know the objective of its infantry, what formations it has adopted to take this objective, the obstacles in the way, the resistance encountered, and the nature and direction of any effective enemy's fire. In order to transmit this varied information, written messages and sketches are used.

Most armies have good signal systems but only those troops who are well drilled in signalling will be able to maintain liaison.

Tactical Liaison

The old battle started with the cavalry, followed by the artillery, and finally ended by the infantry. Today, sound tactics require the simultaneous use of artillery and infantry. The artillery may do the first firing, but that is only due to its long range. The infantry is advancing over dangerous ground and out of rifle range. The artillery must cover this advance. Naturally the infantry suffers heavy casualties. When the infantry reaches the zone of effective rifle fire, it can make use of its two greatest combat assets—mobility and rifle fire. Finally there is the actual shock between hostile lines. During this time the artillery has not been silent for one moment and its fire continues even during the pursuit.

In order to secure liaison before every combat the commander of the troops waits until his artillery is in position. The infantry then takes up special formations and marches into the combat zone. An infantryman prefers to wait under fire half an hour so that the artillery can properly place itself, rather than advance under the fire of poorly disposed artillery. Artillery can destroy infantry, but advancing infantry makes a very poor artillery target. The infantry must advance to draw the fire of the opposing batteries, uncovering their position to the artillery, which proceeds to neutralize them, thereby facilitating a further infantry advance. A halt by the infantry in this stage of the combat is most inadvisable. The infantry should not even halt to fire, as it means a loss of time and of desire to resume the advance. It is very difficult to keep the infantry from firing, as it carries the burden of the battle and wants to defend itself with its own weapons. The infantry should point the bird, and the artillery kill it.

Superiority of fire must be gained by the infantry before its final assault can be made. By superiority of fire is meant superiority of morale, matériel and effective fire. It does not mean an expenditure of ammunition greater than that of the enemy's; nor does it mean the infliction of the larger number of losses. Superiority of effective fire will depend upon the morale and upon the efficiency of each individual in rifle fire. The wild expenditure of ammunition is a sign of poor morale and individual fear.

Spanish infantry regulations state that at a certain phase of the combat the infantry, unless it gains superiority of fire, will find itself unable to advance even with artillery support. This is not true. It should be stated that at a certain phase in the attack it will be necessary for the infantry to open a concentrated, rapid and effective fire on the objective, thus disclosing the intended point of attack. In its first form, the regulation leads to the belief that the artillery fire will not be effective at all phases of the combat, when, as a matter of fact, it is extremely so, but must be supplemented by rifle fire. In general, all infantry progress favors the defense while all artillery favors the attack.

Professional authors state that the artillery accompanies the infantry in its attack. This should be interpreted that the artillery with fire accompanies the infantry attack. The sight of a battery maneuvering into position gives attacking infantry no moral or material aid, but the sight of continuous bursts of high explosives and shrapnel on the enemy's lines has a decided moral and material effect. It makes no difference how far the artillery is from its infantry as long as the foot soldiers can see the effect of artillery fire. In fact, it is exceptional for artillery to venture within the enemy's rifle fire. Besides artillery on the move is out of action, and it is much more effective in well protected, semi-permanent positions.

The German regulations state that artillery in combat should occupy three positions: The first, at long range from the enemy; the second, at between 2000 and 2200 meters; the third, at 1000 meters. These distances vary with the terrain and the nature of each engagement.

With respect to the time when the artillery should change its range there are two opinions. The first is, that the artillery should shift its fire on enemy reserves and supports in plenty of time to avoid any damage to its own infantry. The second opinion is, that the artillery should continue its fire on the enemy's first line position until the instant of assault even at the risk of injuring its own infantry. On the approach of the infantry to the assault, the friendly artillery will change from time fire to precussion fire. (In order properly to prepare infantry for war, artillery should practice firing over advancing infantry at drills and maneuvers.) Next, the infantry charges, making the final rush with fixed bayonets for the desired position. Too much importance cannot be given to the bayonet. Troops who have confidence in their bayonets will learn to look upon the entire battle merely as a preparation for the infantry charge, and with this confidence will come the dominant desire to conquer,

INFANTRY—Continued

which makes a bayonet charge irresistible. Once the enemy's position is taken the artillery is the first arm to move up into this position, still supporting the infantry against the ever-increasing hostile artillery fire. The infantry, for its part, will protect the artillery against attack. The closest infantry units will protect the artillery flanks and rear. No special artillery guard will be necessary. The security of this arm is threatened most at the beginning of an action when it must depend for protection upon the infantry in its immediate front. A special guard, consisting of as high as two companies per regiment, may be given the artillery. As this breaks up the infantry regiment, it is much better to organize and train special units in time of peace for this duty. This would not break up a regiment's combatant strength, and the artillery guard, being specially trained, could even be used to replace casualties in the gun squads.

Moral Liaison

All plans and efforts will fail under the stress of battle unless there is a thoro understanding between officers of artillery and infantry. This cannot be gained by superficial friendships between both arms. It is a brotherly understanding and appreciation of each other's abilities and limitations. It must be gained in peace time, and it necessitates the subordination of personal ambitions and the feelings of superiority that officers of one branch have for those of another. There must be a mutual feeling of dependence and confidence. The infantryman must know how much the artilleryman can give and how it is given; and the artilleryman has to know what his infantry does and its manner of acting. There should be a common doctrine published for the study of all army officers, dealing with the use of each arm and its relation to every other arm.

—Tactics—Instruction and Training

See also

INFANTRY—INSTRUCTION AND TRAINING

—Use of in European War

[The War on Land. *Army & Navy Gazette*, Sept 15, '17. 1100 words.]

The "storm troop" theory cannot be called bad, but its adoption is a sign of weakness. It is an acknowledgment that large sections of the forces are inferior to the general run of the enemy. Storm troops may be organized by picking out the better battalions for attacks and for positions of danger, or, as the Germans have done from the Meuse to the sea, there may be built up small units, sections, companies, battalions, by a man-by-man picking and choosing among all the battalions of the division. However, such procedure produces a reflex effect on the unselected troops that are thus publicly dubbed "ordinary."

The men in the emasculated battalions drop into a still lower grade than they occupied before. If an army in full enjoyment of the initiative has among its units some irregulars or inferior troops it may make good use of these on many occasions as the history of war has sometimes shown.

INITIATIVE

[Initiative. By Major Eneval. *Revista Militar*, Oct, '16. 700 words.]

(A brief article on the value of initiative.)

Commanders should seek to develop and foster initiative in subordinates. Modern officers appreciate its value to any military institution. There is no mission, however insignificant, that does not require its application.

INSIGNIA, Military

See

UNIFORMS—INSIGNIA

INTELLIGENCE

See

SECURITY AND INFORMATION

INTENDANCE SERVICE

See

SUPPLY AND TRANSPORT

INTERNATIONAL LAW

See

ESPIONAGE
PEACE PROPAGANDA
PRISONERS (OF WAR)

[Notes on International Law. By Captain A. Mujica, Chilean Army. *Mem. del Ejército* (Chile), Sept, '16. 5600 words.]

A very interesting study dealing with the situation which, according to International Law, confronts the civil population of an invaded country. Also the status of property and of moneys. The writer discusses the principles adopted by the Hague Convention regarding the rules of land warfare.

In spite of the fact that the belligerent nations have placed before public opinion of the world numerous complaints concerning the violation of the laws of war by the other belligerent, the writer is of the opinion that after the war is over, none of the principles of International Law will undergo great changes.

[Original article not adaptable to a satisfactory condensation. In the main, the subject-matter of this article is treated in our "Rules of Land Warfare." —ED.]

INTRENCHMENTS

See

ENTRENCHMENTS

IRELAND

—History

See also

FRANCE—HISTORY (Article: "The Irish Troops, etc.")

ITALY

—Aeronautics

See

AERONAUTICS—ITALY
AERONAUTICS—MATERIEL
DIRIGIBLES—ITALY

—Army—Cavalry
See
CAVALRY—ITALY

—Army—Supply and Transport
See
SUPPLY AND TRANSPORT—ITALY

—History
See also
EUROPEAN WAR

—Military Topography of
See also
EUROPEAN WAR—GENERAL NOTES ON OPERATIONS BY THEATERS—SOUTHERN THEATER

JAPAN
See also
NAVAL CONSTRUCTION—JAPAN

—Aeronautics
See also
AERONAUTICS—JAPAN

—Army—Engineers
See also
UYEHARA, GENERAL BARON YUSAKU

—Army—Instruction and Training

[Observations on Interior Economy and Education of Troops. By Toku Narita, Major of Artillery, Japanese Army. *Kaikosha Kiji,* May, '16. 3000 words and many headings and sub-headings.]

(A continued article from previous issues. This number starts with the 14th chapter on the administration of the cobbler's shop, which subject is divided into thirty-two sub-headings such as cleanliness, discipline, care of property, storage of materials, repair materials, division of the duties of the men therein, etc. The 15th chapter takes up the kitchen, its discipline, cleanliness, duty roster, etc. The 16th chapter discusses repairs to barracks under eleven headings, the 17th chapter the dispensary, the 18th the veterinary dispensary, the 19th the officer's assembly room, the 20th the library, the 21st the non-commissioned officer's assembly room, and the 22nd the canteen. These different subjects are not discussed in full, but are mostly tabulated under headings and in the form of questions.

The second grand subdivision of the article then takes up the general question of education under many headings. The object of the education of troops is to train them in the art of war and in discipline, and to teach them the great importance of loyalty to the crown and to the army. The officers from the regimental commander to the detachment commander must be educated and trained so as to be able to train and teach the men. Inspections, horse training, horse equipment, stables, men's clothing, men's equipment, etc., must all be given great attention by the officers. The higher officers must train and educate the lower ranking officers in these matters if the army is to be of any value.)

[Patriotism and Military Spirit. Discussion and Personal Interpretation of the Imperial Mandate. By Major-General Matsui. *Kaikosha Kiji,* May, '16.]

(The writer had previously spoken to the officers when he was first attached to the same unit for duty about this subject. He had obtained his personal ideas about the meaning and interpretation of the Imperial mandate from reading many books on the subject. The Imperial mandate is in this case a mandate gotten up for the military forces of the country to teach them the sacred duty of love of country and service to the Emperor. This article discusses it sentence by sentence and gives the writer's personal interpretation of its meaning.)

—History
See also
EUROPEAN WAR—FAR EASTERN THEATER

[Japan—As Our Friend. By T. Miller Maguire, LL.D., Member of the Order of the Rising Sun of Japan, F. R. Hist. Soc. *United Service Magazine,* Jan, '17. 1600 words.]

(Japan during the present war.)

JOFFRE, Marshal Joseph Jacques Césaire

[Notes of the European War. *Army & Navy Jour.,* Jan 6, '17. 125 words.]

Gen. Joffre turned over the command of the French armies of the east and north to Gen. Nivelle on Dec 18. The principal officers of the headquarters staff remain until Gen. Nivelle can form his own staff.

[Famous Engineers of the Allied Armies—Joffre. By Col. B. R. Ward, R. E. *Royal Engineers' Journal,* Feb, '17. 4500 words.]

Joseph Jacques Césaire Joffre was born at Rivesaltes, in the province of Roussillon, Jan 12, 1852. Before his 18th birthday he succeeded in entering the Ecole Polytechnique near the top of his class. During the Franco-German War he was gazetted a sub-lieutenant of engineers, and was on duty in one of the Paris forts thruout the war. After the war he completed his studies at the Ecole Polytechnique, graduating Sept 21, 1872, as a lieutenant of engineers.

Joffre was gazetted captain in 1876. From 1884 to 1888 he was in Indo-China. Upon his return to France he was promoted to major and was employed for a short time in the military railway service until his appointment as professor of fortifications at Fontainebleau. From 1892 to 1897 he was in the Soudan and in Madagascar and added considerably to his reputation. He was promoted lieutenant-colonel in 1894, colonel in 1897, and brigadier-general in 1901. In 1905 he was given command of a division, with headquarters in Paris, and was appointed a member of the Technical Engineering Commission. In 1909 he commanded the Second Army Corps at Amiens, and was Inspector of Military Colleges. In 1910 be became a member of the Superior War Council and the next year was designated as Generalissimo in the event of war.

JUTLAND, Battle of

[The Naval Battle of Skagerrak. (German account.) *Memorial de Caballería,* Aug, '16. 3000 words.]

JUTLAND, Battle of—Continued

The losses of both fleets during the combats are as follows:

Superdreadnoughts, 2 English, no German.

Dreadnoughts, 2 English, 1 German (lost after the battle).

Armored cruisers, 3 English, 1 German.

Small cruisers, 1 English, 4 German (1 after the battle.)

11 destroyers and 1 submarine, English.

5 destroyers and 5 torpedo boats, German.

The proportion of forces in this battle was: English, 2; German, 1. The proportion of loss in large ships was: English, 4, German, 1. This account shows the error in the British statements with reference to the importance of the rôle of the German dirigibles and submarines. In reality the battle of Skagerrak but confirms the truth of the old belief that the battleship dominates the seas.

MATERIAL RESULT OF THE GERMAN VICTORY OF SKAGERRAK

English ships sunk:

	TOTAL TONS
2 superdreadnoughts	59,000
2 dreadnoughts	39,350
3 armored cruisers	42,300
1 cruiser	5,530
11 torpedo boat destroyers	11,710
1 submarine	800
Total	158,690

English ships seriously damaged:

	TOTAL TONS
3 superdreadnoughts	86,000
1 armored cruiser	12,200
3 small cruisers	10,000
9 torpedo boat destroyers	10,000
Total	118,200

Losses in men:

England, 2 rear-admirals, 350 officers and some 8000 sailors.

Germany, no admiral, 172 officers and 2414 sailors.

German ships sunk:

	TOTAL TONS
Lützow, dreadnought	24,350
Pommern, armored cruiser	13,200
Wiesbaden, small cruiser	5,000
Elbing, small cruiser.	5,000
Rostock, small cruiser	4,900
Frauenlob, torpedo boat destroyer	2,700
5 torpedo boats	4,000
Total	59,150

KAPOK

[Kapok. A National Product. Of Use for the Passage of Water Courses. By Lieut.-Col. Garcia. (Reprint from *La Nación.*) *Revista Militar,* Sept, '16. 1000 words.]

Kapok is the fiber of the plant called *samuhu* or *palo borracho,* which is found in great abundance in the deserts of Chaco, Santiago, or in the territory of Misiones. This fiber is in the nature of a vegetable silk, imputrescent, impermeable and insubmergible. It is used extensively in France and England in the manufacture of capes and blankets for the armies, rope for ships and stuffing for mattresses, pillows, etc.

It has a buoyancy of 35 times its weight, while cork has only 5. Experience has demonstrated that kapok after an immersion in water of one month retains a buoyancy of 26 times its weight. Its buoyancy is superior to that of any other known fiber. A suit made of it would serve as a life-preserver.

Its elasticity and softness render it superior to hair, wool, or feathers for filling pillows and mattresses.

Commercial use of kapok was made possible by the invention of a machine for separating the fiber. The inventor, a Frenchman, gave satisfactory proofs of the utility of articles made of kapok to representatives of the ministries of war and marine of both France and England. The tree is indigenous to Argentina, and is found in such quantities that it is regarded as a nuisance by land owners.

KITCHENS, Military

[Field Bakeries and Kitchens in France. Quoted from *La Nature. Memorial de Artillería,* Nov, '16. 400 words.]

One of the most difficult problems in war and one requiring the most careful attention of higher commanders, is the feeding of the soldier. *La Nature* has recently published a very interesting article on this matter, from which a few extracts will be given.

The various corps of the army possessed field ovens, well constructed and in sufficient numbers, but the methods of preparing the food were old and not up to date. Up to the battle of the Marne, they failed in supplying food and even bread to the troops.

The military authorities at once attempted to correct these conditions, with the result that the army has been equipped with new matériel of this nature for the production of bread as well as the preparation of food. This matériel, as well as the methods employed appear to have given very satisfactory results.

Without going into details, it may be stated tha the field ovens are divided into three classes: Built-up ovens of a permanent nature, portable ovens, and automobile ovens. All of the above are arranged to cook at will biscuit or bread. The average production of one of these ovens is about 2000 loaves daily.

In the preparation of food, the old camp kettles have been abandoned for portable kitchens mounted on wheels, which accompany their respective battalions. These are set up in the open air about 2 kms. in rear of the front.

One of the portable kitchens described in the above article consists of two parts. The first is a caisson or limber, divided into compartments for carrying the components of the ration. The second is the stove proper, in which the oven and two kettles for soup and coffee are to be found.

The authorities have not only seen to it that the troops are supplied with food, but also that it is supplied to them hot wherever it may have to be con-

sumed. In order to effect this, use is made of a Norwegian type of kettle for delivering the food to the troops. This kettle consists of two walls with a vacuum space between them, similar in principle to the well known "thermos" type of utensils.

—Bakeries

[Latest Truck Use is for Portable Bread Bakery. *Commercial Vehicle,* Sept 15, '17. 800 words. Photographs.]

This bread making machine is the only automatic unit in existence that will completely make a loaf of bread and perform all the functions customary to hand labor. It mixes the ingredients into dough, molds any shape of loaf desired, and divides it into predetermined weights. The only time lapse is while allowing the first batch of dough to rise.

The capacity of this machine is from 1000 to 6000 loaves of any size, weight or shape in one hour. With five men employed it will do the work that now requires the services of one hundred and twelve men. In addition the dough is mixed in a sanitary manner, the finished loaves being discharged into baking pans ready for the oven.

In camp, the machine may be operated by the truck's engine or electric power, a motor being part of the equipment. The truck engine operating at a speed of 500 r.p.m. will run the bread making machinery. Any one unit of the machinery may be run independently of the others.

—Field-Kitchen Wagons

[New Truck Kitchen can serve 2000 men an hour. *Commercial Vehicle,* Oct 1, '17. 700 words. Illustrated.]

This new type of motor is capable of serving 2000 men three meals a day and with its crew of three men will replace twenty of the old style company kitchens, which require eighty men and forty horses for their operation.

The outfit is mounted on a 4-ton Riker truck and consists of a 10-h.p. vertical steam boiler, two 90-gal. soup, stew or pot-roast kettles and two 50-gal. coffee urns. The boiler is of the fire-tube type and burns coal, wood or oil. Both the kettles and the urns are of a special steam-jacketed type for quick boiling. They will raise water from 62 deg. Fahr. to 212 deg. in 6 minutes. This time may be decreased by using the Penberthy injector on the boiler which puts water into the urns and kettles at 190 deg. Fahr.

The boiler is mounted directly aft of the driver's seat, with a space to the rear between it and the two soup kettles to enable it to be fired. The two coffee urns are at the extreme rear. The side boards of the body may be folded down to form a platform for the serving crew, the tailboard also swings down and may be reached from the ground by a short flight of steps. A small amount of wood or coal fuel may be carried in the right side of the boiler, while a removable table is provided on the left side.

It is planned to add a 6-kilowatt generator to the outfit and to have it operated from the truck engine to furnish current for the officers' tent, for a searchlight and for the operation of a field wireless station.

—Field Ovens

[Field Ovens in Mexico. By First Lieutenant J. W. Weissheimer, 17th Infantry. *Infantry Journal,* Feb, '17. 1700 words.]

(A description, with three detailed drawings, of how to construct in the field, where adobe or clay is obtainable, certain types of practical field ovens. Cautions as to what not to do and specific directions as to what to do fill the article. A special style of combination stove and oven, introduced by Cook Traylor, Supply Co., 17th Inf., and known as the Traylor oven, is detailed at length. The author shows how this cooking apparatus, constructed from materials at hand, became not only popular but effective, one company turning out 150 loaves of bread in an afternoon.)

KITE BALLOONS

See also

Balloons—Captive

[Construction of Kite Balloons. By R. H. Upson. *Aviation,* Dec 1, '16. 1400 words. Illustrated.]

Types of military apparatus which are considered a necessity today may be on the scrap heap tomorrow, and yet by a curious reversal of conditions the obsolete and forgotten of years ago have become a necessity today. The kite balloon now in general use is merely a combination of two principles, one nearly as old as civilization itself, the other discovered over a century ago. Neither principle alone ever quite filled the bill. A man-lifting kite required a strong wind to fly it; an ordinary captive balloon could only be flown in a comparative calm. But in the kite balloon we have a combination that can take care of either condition. The balloon itself is cylindrical in shape and kept in an inclined position like a kite by the wind blowing on the under side; this counteracts the contrary tendency of a wind to blow the balloon over toward the ground. Notwithstanding the great superiority to the spherical balloon, the kite balloon still left something to be desired in the matter of steadiness. Even when loaded with tail cups, the use of binoculars was difficult and severe sea-sickness was an item to contend with. The highest wind in which good observation could be made was 27 miles per hour. This carried the balloon over to a considerable angle, seriously limited the altitude attainable, and at the same time put a disproportionate strain on the cable. The resistance of the kite balloon may be considered to be made up of parts as follows: the resistance of the gas-bag itself, the resistance of the steering bag, the pull of the tail cups, resistance of the cordage and basket, and the resistance of the anchorage cable. A radical departure from the original design was necessary in order to make an increase in the steadiness by increasing the effective lateral surface of the steering bag, and finally a practicable form in what is known as the Goodyear Kite Balloon was obtained whose principal features are the shape of the gas bag, which is modified so as to have a minimum resistance; the steering bag is replaced by an air funnel which carries a tail cup and has a valve thru

KITE BALLOONS—Continued

which air enters to make good any deficiency in pressure. The keel, like the funnel, is non-rigid, being supported entirely by a proper balance of forces; the side fins are so shaped and disposed that they help in the stability as well as the kite effect of the balloon. The function of the tail cups has been reduced almost wholly to one of damping the motion of the balloon in a gusty wind. Superfluous cordage and protuberances have been eliminated. A valve has been designed to prevent leakage. The air valves have also been made tighter, thereby cutting down the quantity of air required to keep the balloon properly inflated. The proper angle of inclination of the balloon in the air must be calculated with considerable exactness. If it is inclined too much it carries the balloon over and puts an undue strain on the cable, and if the balloon is too nearly horizontal the lift of the wind is lost. In order to preserve this proper angle for different conditions of use, the basket is made adjustable so that it can be moved forward or back when necessary. In a thirty mile wind there should be no motion apparent in the basket and the cable tension at the balloon should be less than 1000 pounds; an altitude of 4000 feet should be readily attainable.

[Kite Balloons. The Eyes of the Artillery. By a French Officer. *Flying*, Dec, '16. 1800 words. Illus.]

Kite balloons have developed with increasing importance until now they give most important service to the artillery. They hold the lines of the enemy under continuous observation, transmit to the artillery commanders information of every operation that goes on, and also direct artillery fire. The Germans had foreseen the value of these balloons before the war; all other nations had spherical balloons. A balloon company consists of 150 men, who take charge of the maneuvering of the balloon, filling, observation, transporting, and bring it back to earth. In addition there are fifteen wagons, the most important of which is the windlass wagon. This windlass wagon carries a steel cable about the size of a pencil that has a breaking strain of 3000 kilos. In the center of this cable is a telephone wire, connecting with the basket. The motor turns the reel in one direction or another to allow the balloon to ascend or descend. The other wagons carry extra rope, basket and cup-shaped pieces which are attached back to back and make an immense kite tail to head the balloon into the wind; also field-glasses, maps and scientific instruments, camp equipment, and telephone equipment. They also carry cork-screw stakes and pegs which hold the stays of the balloon, sacks of ballast, and a ground cloth to prevent the balloon from touching the ground, all forming necessary parts of the equipment. During an advance, the observer in the basket is directly in touch with the gunners and regulates their fire. The personnel of a balloon company is divided into two classes, the men who pull the ropes and the others. They usually have a captain in command of the company, sergeants to assign the corporals to their ropes and lay out and transport the balloons over obstacles. Eight men handle the envelope, the rigging, place the basket, and adjust ropes and instruments. Four or five mechanicians work the winch, and one cyclist and one motorcyclist serve as messengers. As in the case of all other troops, there is a doctor, a quartermaster, a furrier, tailor, shoemaker, barber, orderlies and all the other little world of specialists who go to make up an efficient unit. The best place for a balloon to ascend is in a forest, which protects the balloon from high winds. Trees are cut down to make a clearing large enough for the maneuvers of ascending and descending. The ground cloth is spread, ten stakes set to attach the balloon, eighty ballast sacks of ten kilos each are placed with their hooks in the network, and a bag containing the balloon is placed in the center of the ground cloth. The valve is attached, the cords straightened out and the filling pipe securely connected. All this takes about half an hour. Hydrogen is brought in from the tube wagons, each tube containing about 150 cubic meters of gas compressed to a small volume. It takes about 130 or 140 tubes and two or three hours to fill the balloon. It usually takes about 15 minutes to get the balloon from the ground into the air after inflation. This time is necessary to unhook the bags of ballast which hold it to the ground, connect the appendix and replace the gas lost during the preceding ascension by expansion, due to the altitude. When the circumstances allow, the balloon remains in the air all the time with one or two observers, who take their meals with them. At night and when the weather renders remaining in the air useless, or when dangerous storms come up, the balloon is brought down, disconnected and made fast for the night under the watch of sentinels. Frequently it is necessary to remain up all night to search out the batteries of the enemy by flashes from the guns. Following is the story of a lieutenant of artillery on his first ascension.

"My basket is a charming little boudoir, hardly big enough to take two steps in. There are three binoculars, maps and telephone very close to me. At my feet I see my companions looking up, with their heads thrown back. The perspective extends rapidly, the horizon gets farther and farther away and the picture changes to a geographical map. Serpentine roads and rivers stretch away in the distance. Just below me is a farm, and the minute dots are animals. In the east a few kilometers away are the zig-zag lines of the enemy's trenches. In the center runs a slender green ribbon which seems intact. This is the ground between the trenches of our first line and the enemy. Here and there are ruined villages, the houses demolished. Scattered about we can see black and white places. These are the shell holes. There are also our own works and batteries, which we know by the puffs of smoke when the guns are fired. From the basket all this is perfectly clear. It is an ideal observatory for artillery. It is true the basket is not always above the positions of the enemy, as is the case with the airplane, but it is stable and you can use glasses without difficulty. There is also the advantage that the observer is in constant communication with the batteries. This communication is more accurate and rapid than in the case of aeroplanes."

KITES

[Military Uses of Kites. By Dache McClain Reeves. *Air Service Jour.*, Oct, '17. 3000 words. Illustrated.]

The uses of military kites have been so varied and important that it seems desirable that kite equipment should be adopted in the army, and men trained in their use. The equipment could be standardized and furnished each regiment of infantry, cavalry, or field artillery, and a detachment of kite specialists be attached to the headquarters company.

The duties of a kite detachment are to establish radio communication thru a kite aerial; to take photographs; to understand and use visual signals, Very lights, etc.; send up flares to aid night operations; and, when engaged in trench warfare, bomb-dropping, etc.

The most important use of kites at present is to support radio aerials. As the field radio set at present is designed, it is impracticable to have it furnished to any unit less than a division, whereas a much smaller set, utilizing a kite aerial instead of a collapsible mast, would prove very useful, and not requiring a large personnel could be attached to each line regiment.

A typical kite equipment would take up very little room and it is probable that experiments with tentative units would prove their success. This equipment would include some type of signaling lamp, a small wireless set, camera and photographic material, and possibly a supply of aerial torpedoes.

The military uses of kites may be divided into three general classes, viz.: observation, communication, and offense. The most common use is, of course, observation. This is usually accomplished by using the kite to lift a camera so arranged as to photograph the landscape below. Besides securing photographs of enemy trenches, etc., aerial photographs of our own encampments, trenches, etc., would be useful as a matter of record. Other instruments also may be sent up, as for instance, barometers, and wind measuring devices over an aviation field, to determine air conditions above.

As a method of establishing communication, kites have rarely been used, and yet this is a field of wide possibilities. In flat country, Very lights and flashes from an electric lamp would be visible much further if the lights were supported 300 feet in the air by a kite. If it were found that the bobbing of the kite interfered seriously with this method of signaling, this could be remedied largely by using two kite wires, one of which is used to raise and secure the kite in the ordinary manner. Another wire attached to the first about one-fourth of its length from the kite is hung vertically, its lower end being secured to the ground and pulled in until the first wire is bent at a slight angle at the point of junction. It will then be found that from this point down, both wires are stable, the upper fourth of the first wire alone responding to the movements of the kite. The instrument is suspended just below the junction of the two wires.

Another use of kites in signaling is to raise aerials of radio stations. In order to maintain an equal length of aerial regardless of the movements of the kite, two systems may be used. One is to suspend the aerial at one end to the kite wire, the other end of the aerial hanging perpendicular, with a weight to hold it taut The method described for securing a suitable support for signaling lamp may also be used.

The third general class of kite uses is even more rare than the second and may be said to be almost entirely undeveloped. This is the use of military kites for purposes of offense. This is possible only when opposing troops are very close together, as in trench warfare, or in a besieged fort. Teams of kites can easily lift one to two hundred pounds and when the wind is toward the enemy's lines, kites can be raised, supporting several bombs, grenades, or aerial torpedoes, and maneuvered until the projectile is over the enemy's position. It can then be released from the kite.

To raise a team of kites without exposing the operator to enemy fire, the following method is one of several that many be used: The kites are carried thru the trenches to a point several hundred yards from the winding winch, the wire being pushed by poles above the trench to the ground, so that it is straight, regardless of the angles of the trenches. The first kite is raised by a collapsible, extension pole to a height of twenty-five feet, and then it is released at the instant that the winding drum is started rapidly. The wire being drawn in at a fast rate, the pressure forces the kite up a short distance, when the winch is stopped and more wire is played out. This operation is repeated until the kite reaches a certain height, when the second kite is bent on, and so on until the team is at the desired height.

Kites can be used to raise flares at night, to illuminate land between trenches and discover listening patrols, as well as lighting the ground and preventing surprise. It is superior to the searchlight in that the source of light can be fired on without endangering the operators; and if the flare is suspended some distance below the kite, the kite still flies even if the flare is hit, and another flare can be drawn up to replace the destroyed one.

In raising kites, it is preferable to raise and maneuver the kite into the desired position and then send up the apparatus on the kite wire. This is accomplished by means of a carriage. This carriage consists of a framework of light wood, arranged to slide on the kite line, and having means for suspending objects beneath it. To cause it to travel up the line, the wind is utilized, the carriage being equipped with sails. In operation, the carriage is placed on the line, and the cargo suspended underneath. The sails are then unfurled and the carriage slides rapidly up the wire until it reaches a point below the kite where a stop is fastened to the line. A trigger strikes the stop and releases the attachment in the case of a bomb causing it to drop. In the case of a camera, the trigger is arranged to operate the shutter of the camera. At the same time, the trigger releases the sail halyards and the sail flies loose, whereupon the carriage descends the kite line by its own weight.

In the case of a flare, the method is slightly different. The stop is provided with a staple, which engages in a hook projected from the end of the carriage,

KITES—Continued

and holds the carriage from descending, while the trigger operates the necessary mechanism to light the flare.

The Hargrave kite, as well as the Malay and several other types are well adapted to this work.

KNIVES

See also

INFANTRY—ARMS

KUT-EL-AMARA, Battle of

[The Recapture of Kut. *Army & Navy Gazette,* Mar 3, '17. 1000 words.]

In the campaign for the recapture of Kut, the British did not trust to the river as a single line of communication. They laid down railroads which have kept the troops well and regularly supplied.

LAFAYETTE FLYING CORPS

[The Lafayette Flying Corps. *Flying,* July, '17. 2700 words, illustrated.]

The Allies' unanimous request to the United States to concentrate in training aviators and manufacturing airplanes, so that the combined Allies' Air Fleets may strike a decisive blow at Germany, can be traced to that wonderful organization—the Lafayette Flying Corps.

The Franco-American Flying Corps was organized by Dr. Edmund L. Gros, an American physician, who has lived much in Paris; Frederick H. Allen, a lawyer of 62 Wall Street, who has also been a frequent visitor to France and is widely known because of his identification with the first American relief work in France, and Lieut.-Col. Thomas Bentley Mott, now military aid to Commissioner Elihu Root in Russia, but in the Spring of 1915 an associate in the banking house of Bonbright & Co., in Paris.

There were Americans fighting in the Foreign Legion, but their identity was lost in this body; they were simply units in a tremendous group.

The French Government agreed to accept volunteers under conditions which guaranteed that the American fliers would never be ordered into service outside their own squadron except with their own consent.

The Franco-American Flying Corps was created in March, 1915. Patriotic Americans in France provided the funds to finance the beginning and the French Government agreed to provide opportunity for exactly the same training that French fliers received.

The first members of the corps were recruited from Young Americans then in France and included William Thaw, Norman Prince, Eliot Cowdin, and others.

The brilliant achievements of these daring Americans attracted other red-blooded young Americans, and many found their way to the Escadrille and subsequently became famous aviators.

To-day, after a little more than two years, the corps comprises about 200 young Americans.

The corps pays each flier 150 francs, or about $30 a month, in addition to the French wage of 5 cents a day, plus rations. Each member of the Lafayette Corps receives $250 in cash and leave for forty-eight hours in Paris for each German flier he brings down, and there are other prizes for less spectacular tho equally valuable work.

From a small beginning the corps is developing until the financing of it alone has provided a problem which keeps its sponsors busy.

Candidates who apply are required to fill out a form, giving the names and nationality of their parents and grandparents on both sides of the family.

This same blank inquires into a candidate's education, favorite sport, the languages besides English which he may speak and the clubs to which he may belong.

Assuming that he has again fulfilled requirements the candidate must pass a physical examination with especial consideration of his vision.

But their most severe test is ahead of them. No longer are candidates sent abroad without inspection as to their flying sense and ability, altho it is not required that they have ever before sat in an airplane.

The candidate takes his seat in the forward compartment of a double controlled training machine, and the professional pilot sends the craft aloft. He mounts several thousand feet into the air and performs all the simple evolutions of vertical diving, banking and slipping, as it is called when an aircraft is intentionally permitted to skid. He remains aloft for from one-half to three-quarters of an hour, and thruout this period he observes the pupil in the seat in front of him.

The pupil is instructed in the use of the controls and is told that once aloft the instructor will turn the craft over to his guidance, indicating by signal the moves he is to make.

Altho this may be only the second time the student has ever been in an airplane. the instructor, nevertheless, turns over to him the control of the plane after he has climbed to an altitude sufficiently high so that the instructor may have an opportunity to correct a mistake before an accident ensues. The double-controls are synchronized so that the instructor can tell by the feel of things just how he manipulates the controls, whether easily and confidently or rigidly and nervously, and also he can instantly correct a mistake which might mean death to both if it were not rectified.

The men, on landing in France, go by train to Paris, where they report and for a week or so are detained in Paris. They are then sent to the training school, which at present is situated at Avord, in the Province of Cher, and there their real training begins, and they begin to draw pay at the rate of 5 cents a day from the French Government and a dollar a day from the Lafayette Corps.

They are put first in so-called penguins, airplanes with wing surface and power so reduced that they cannot leave the ground.

Proficiency in this attained, they are placed in "jumpers," machines which will leave the ground for about six feet, maintain this altitude for a few yards, and then descend to the grass again.

Finally real flying is learned, and then advanced instruction is given in what we here a few years ago regarded as only trick flying. Men learn to loop-the-loop without losing any altitude. They learn to fly up-

side down, to perform a tail spin in which the craft, revolving like a top, drops tail first and can be set back on the level only by the most consummate skill.

At last they are brevetted to the front as corporals and, in accord with the agreement, are assigned to the famous Lafayette Flying Corps, Escadrille 124.

Once he has become a sergeant, he may duel with the Germans to his heart's content, and already several of the Americans have become "aces" as the men are known who have brought down five or more Germans within the French lines.

Since the beginning of the great war the Escadrille 124, as the Lafayette force is officially known, has been composed almost exclusively of Americans and these, for the most part, have been recruited in this country.

They have been drawn from all ranks, and there is no requirement as in the United States force that a flier must have a college education or its equivalent.

In one other essential does the Lafayette Corps differ from any branch of the service in the United States; the corps is privately financed and, altho candidates upon admission receive the regular French Army pay, the pay is augmented by the organization which created the corps, the whole expense of its activities being so heavy that it is essential the candidate pay his own way up to the moment that he is accepted by the French Army as a student aviator.

LANDING OPERATIONS

[Landing Operations. By Rear Admiral Degouy. *Revue des Deux Mondes,* Aug 15, '16. 7400 words.]

Before the present war, scarcely anyone would admit that large forces could be risked upon the seas.

Hence the surprise among military men when the German general staff advanced the idea of an invasion of England.

"It is only a feint," it was said; "the undertaking is contrary to all existing principles, and would be sheer madness."

It was in no wise a feint; neither would the undertaking have been madness, if the Germans had succeeded in taking Calais and the salient made by *Gris-Nez* in the direction of England's coast.

First it must be observed that in an operation of this kind *the difficulties pertaining to any particular case* must be studied. Theorists unfortunately do not do this. They condemn such operations offhand, "because the forces to be transported by sea are insignificant in comparison with those who will receive them; because the transportation of troops is too dangerous on account of the new submarines constructed; because the organization of a satisfactory base upon the hostile coast is too complicated a matter; because the first troops disembarked run too great a risk of being driven into the sea, since the railroads will permit the defender to bring up troops faster than the ships, etc., etc."

These are abstract arguments. To consider that of the submarines: did they prevent the taking of the allied armies to the Dardanelles, then to Macedonia? And did not the Serbian army arrive at Salonika? We need not mention the continual going and coming to and from Calais. Who will say that similar protection cannot be found for a longer crossing, or that a large movement will not be preceded by preliminary operations designed to shut in the submarines? So long as submersible craft do not find a method of getting thru steel nets; or of gathering up automatic mines as fast as they can be sown; so long as light surface boats, aided by hydroplanes, can effectively pursue submarines in the shallow waters of the coasts; so long as behind this first line of barriers, a second can be established of cruisers of various tonnage, and a third of relatively old armored battleships, while the "dreadnoughts" are held in the open to provide against any contingency, then just so long may success be expected of the protective measures that can be organized by powerful navies that command the seas.

As to the theory of the superiority of railroads in bringing up effectives, the landing may be effected at a point not reached by the railroad; also the fleet can hold the railroad under fire, and its flat bottomed auxiliaries, gun-boats, monitors, etc., even its aerial craft, can easily go and destroy bridges or ferries that may be indispensable for the bringing up of the defender's reserves.

War brings us before facts, positive facts, and concrete, definite problems, for the solution of which we may not content ourselves by applying empty formulas, usually inspired by preconceived ideas, by fear, or irrational prejudices.

In applying the principle laid down, as to the necessity of making a special study of each case, an examination may be here made of a combined operation, which must sooner or later occur as the terminal act of the present great drama.

The first great difficulty of the discussion is the necessity of avoiding a definite statement of the problem in mind. The sagacity of the reader must be relied upon to grasp the point of the discussion.

This combined operation comprises several phases. First there is the phase of political preparation.

Our allies must be persuaded of the necessity for closing entirely the steel circle which now encloses only three-fourths of Germany's powerful body.

Germany has obtained much more by terrorizing than have the Allies by moderation. There can be no illusions on this point. The honest scruples of the Allies in regard to respecting the neutrality of smaller Powers have been discounted. They have been blamed for the comparative vigor of their examinations into the matter of fictitious destinations; whereas those who have violated at every moment all the rules of international law, penetrating into territorial waters to make captures, systematically flying over neutral countries in their Zeppelins, anchoring mines on the high seas and on the most frequented routes of navigation, sinking, even without warning, any vessel suspected of carrying cargoes to Great Britain, have been opposed only by timid representations.

It is for us to bring to the attention of our Allies, particularly Russia and England, all the considerations involved in the idea of an energetic and decisive action by the Entente on the fourth front, the idea of taking effective possession of the Baltic.

LANDING OPERATIONS—Continued

The second phase is the diplomatic phase [a discussion of the attitude toward the contending parties of certain neutral countries, particularly of Denmark and Sweden, and of the effect upon them of the present and prospective methods of conducting the war].

The maritime phase will infringe upon the diplomatic phase. The effect cannot be discussed in detail. It may, however, be mentioned that certain preliminary operations should take place. One of these is the obliteration of the German maritime canal. This canal can be attacked by the huge aerial bomb-carrying craft which we are constructing, and which have shown at Essen what they can do when used in mass and with rigorously applied methods. But for the squadrons that will be assigned to this work a well organized base near the objective is necessary. This base, almost indicated, is only about 100 kilometers from the center of the canal, Rendsburg. In taking possession of this point, the Allies will oblige the German fleet to come out and give battle,—a second battle of Jutland, if for other reasons, that event shall not already have taken place. It is quite clear that a combined operation cannot be undertaken unless one is completely master of the sea.

Another preliminary operation may be expected. It may be given the general designation of "Forcing a strait defended by mines covered by shore batteries."

We here face one of the great difficulties which one can urge against the enterprise with which we are occupied. The memory of the check received in the Dardanelles will of course linger in mind. But again we must emphasize the necessity for distinguishing between cases.*

The strait we have in mind in no way resembles that of the Dardanelles.

Let us not forget that, beside dredges, we have mine planters in our fleet. The field automatic torpedo was first called a blockading torpedo, and was intended to close a port against the egress of a fleet. These machines would be of use.

For opposing the shore batteries, at the water level and in the open, we have monitors heavily armed and well protected, which did not exist in March, 1915. These have mortars and howitzers, a complete siege equipment. After 26 months of firing here and there at shore batteries, the vessels have learned what is needed and are equipped with guns for curved fire, and guns for throwing projectiles having thin walls and carrying heavy charges of explosives.

After these indispensable preliminaries, the maritime phase includes the operations of transporting the army, which operations are more complicated than difficult, and which will require long and careful preparation.

First the means of transport must be secured. The trip being short, we may take as a basis for discussion the figures of 1000 tons' displacement per 300 fighting men, including accompanying matériel. For an army of 150,000 men, we should therefore need 500,000 tons, which need not be considered a terrifying total in view of the tonnage at the disposal of the Allies. The economical difficulties that will ensue must be provided against long before requisitioning the necessary ships.

To avoid a very serious danger, minute care must be taken in foreseeing every contingency. Great stocks of food and supplies must be provided, also new and extensive docking, wharfage and loading facilities must be constructed and completely organized and equipped; also tugs, lighters, barges and all necessary floating auxiliaries for embarking and disembarking the army without stripping the home ports of equipment.

Not only the transport and supply fleets, but also the fighting fleet, must receive the closest consideration. The latter must be adapted to the very complex exigencies that must arise in the transport operation. We have often said that one could never have enough *light* battleships.

This crying need received scant attention in the fine days when we thought of nothing but building dreadnoughts upon dreadnoughts. After a deplorable lapse of months, we have again begun to build light surface and submergible units. But not only ourselves but our Allies must recognize that what we need is not only destroyers and submersibles, but flat-bottomed, river warships, well armed. These may have to flank one wing of an army along a river, or quickly to gain the mastery of a *Haff* whose channel the transports may have to ascend.

It is also important to have many torpedo boat destroyers to use as watch-dogs for the flanks of the columns of steamers, to keep the submarines away.

Then there are the aerial craft: the hydroplanes, perhaps dirigibles too (tho not necessarily super-Zeppelins), and all the special vessels needed for these machines; and the supply ships for the fleet, such as repair ships, colliers and ships carrying water, petroleum, etc. Undoubtedly the task is complicated, requiring much forethought, exact calculations, will power, and perseverance.

Coming to the last phase, which we may designate as the military phase, we may consider it as comprising the landing, the organization of the base, the advance, the maintenance of the army by a regular inflow of reinforcements, munitions, matériel and provisions.

The matter of landing need not be dwelt upon here. It has been seen to succeed remarkably well under the worst kind of conditions. If well conducted, and if, thanks to the mobility of the fleet, the defender is deceived as to the exact point of attack, serious resistance should not be encountered, at least in the first 24 hours.

No railroad will last. It is also known how difficult it is to cause strings of convoys to turn back once they have started on the wrong road.

In the Bay of F. south of one of the Scandinavian capitals, the expeditionary fleet will at the same time threaten several points of the German coast, which are accessible and favorable to a landing in force. These points are found along a considerable length of

*Since that unfortunate day of March 18, 1915, armored ships have been provided with important protective arrangements.

coast, more than 300 kilometers. The geographic conditions would aid a skilful assailant in taking the defenders at a disadvantage.

There is a need for an intermediate base, as a landmark in this line of operations, which, as soon as the army disembarked, would become its line of communications.

But the real base of the army would be the point of landing, or the nearest commercial port. Such ports exist near the beaches where a landing could be effected, and possession would immediately be taken of such a place, as Napoleon, having reached Aboukir, immediately took Alexandria.

The organization of this base, which should at the same time form the core of an impregnable armed camp, is one of the essential factors of success.

It should be observed that with a plan of operations carefully studied out at leisure, anticipating possible landings at several points, depending upon circumstances, there could be made ready in advance almost everything necessary in the way of wharfs, hoisting engines, railways of various gauges, wagons and carts, portable warehouses, field hospitals, coal supplies, reservoirs of oil, aërostation sheds, distilling boilers, motors, etc.

The entrenched camp, which would have to resist the assaults of the defenders during the critical period of the organization of the army, should of course be established with all possible haste. Also, immediately, should be taken measures to ensure the safety of that portion of the transport fleet which will have to remain at hand ready for use in case of an enforced reembarkation, while another contingent is occupied running to and fro between the expeditionary army and the home ports.

In the past months we have progressed in the art of "entrenching" fleets at anchor. If, in the landing expedition, possession can be obtained of a nearby harbor, especially of one at the mouth of a river having a wide, deep channel, the problem of the protection of the ships will be simplified.

"I believe that one can always disembark," General Millet used to say, "but the difficulty will be in advancing." Of course the defenders will not be slow in reaching the point of landing; but can his trains bring troops faster than our ships? No, not if we have taken proper measures to secure prompt and successful disembarkation, prompt and vigorous action thereafter, and have in our favor, among others, such essential factors as a strong-willed commander and enthusiastic troops.

[Landing Operations. By Giovanni Marietti. *Journal of the Military Service Institution,* Jan-Feb, '17. 9000 words.]

(The growing importance of the transportation of oversea forces in modern war is manifest. Without a tiresome delving into statistics the author discusses in all its phases and rather in a popular strain the problem of equipping, transporting and maintaining a large oversea force.)

LANDINGS (Aeronautics)

See
AERONAUTICS—AIRPLANE LANDINGS

LATRINES

—Field

[Latrines and Kitchen Incinerators. By Major R. H. Pierson, M. C., U. S. A. *The Military Surgeon,* Aug, '17. 2000 words. 9 illustrations.]

The health of troops in camp often depends on the efficiency of the means employed for the disposal of excreta and garbage. Methods must be simple and suited to field conditions. Destruction by fire is best but not always possible.

Incinerators. For one night camps the shallow trench in which the kitchen fire is built will suffice. For camps of longer duration, the horseshoe incinerator with rock lined sides may be constructed, but its value depends on the nature of the soil; in clay soil they do not give good service. If troops are to occupy the same site for several months, some form of kitchen incinerator should be used that will completely burn all solid kitchen refuse and cause the evaporation of all liquid waste with no danger of soil pollution. To obtain these results, the Guthrie incinerator was developed: (A modified form is described and illustrated, intended to remove the objections to the original type that it wasted wood, evaporated water too slowly, that the sides sometimes fell in, etc.)

Latrines. For permanent camps, latrine pits closely covered by boxes are recommended. These pits should be either frequently burned out or treated with sprays of coal oil. Burning out is better if it can be thoroly done. This requires that the pit should be fired once daily by the use of hay treated with crude oil. If the covering boxes are made of wood, and not removed before burning out, the fire cannot be made hot enough. On the other hand, removal entails an excessive amount of labor, the boxes are soon broken, the pit sides cave in, and the pit becomes substantially an open one. Hence the latrine box should be of pressed steel, to accommodate four men at once. In general, the seating capacity should be for 8 per cent of the strength of the organization. (Construction data are given, but not in great detail. The process of spraying is described in full.) Straddle trenches are employed only in camps of but a few days' duration. The trenches should be from 8 to 10 inches wide, and not more than 18 inches deep. Defections are immediately covered with earth. Each trench will last but a day or two; when filled, another should be dug parallel to the first one and nearby.

For temporary camps, the canvas latrine screen supplied by the Q. M. C. answers all purposes, but in permanent camps, lumber shelters are best. Shelters should not be screened. It is desirable to have a separate pit for urine, dug at the end of the shelter. Its size will depend on the permeability of the soil; usual dimensions are 5 feet deep by 2½ wide by 3 long. The pit is boarded over and covered with sod or earth. Thru this layer passes a straight 2-inch

LATRINES—Continued

pipe to the urinal above, made of light galvanized iron fastened to the end of the latrine. Urinals should be swabbed every day with crude oil.

LAW

See

AERONAUTICS—LEGAL REGULATION OF

INTERNATIONAL LAW

—Military

See

COURTS-MARTIAL

IMPEACHMENT

[Suggestions on Military Justice. By Luis R. Quiquisola, Secretary to the Judge-Advocate, 2d Division. *Rev. del Circulo Militar,* Dec, '16. 1400 words. (To be continued.)]

The office of the judge-advocate is one of the most important in the administration of military justice. On the form and detail with which he prepares the case depends that clear presentation of facts so necessary to the determination of the exact degree of guilt of the accused, accomplices, etc., and the proper penalties to be adjudged.

Our judge-advocates are competent and efficient officers, well versed in all that pertains to the military side of their duties, but their assignments not being permanent, they are not able and cannot be expected to be equally prepared on the legal side, and many of the errors which appear in their work are due to lack of knowledge of principles of law and legal procedure.

The judge-advocate should possess not only a profound knowledge of the Military and Penal Codes, but also of those chapters of other laws and codes that have application to military justice, and this knowledge should be cultivated and tested by practical exercises in the solution of hypothetical cases involving unusual difficulties and complications.

It has been suggested that civil lawyers might be successfully employed as judge-advocates. No doubt the lawyer has the mental equipment and legal knowledge to exercise the judicial function, but there are few lawyers indeed who possess that knowledge of military legislation and of the regulations, decrees, and dispositions which govern the army that is so necessary to the judge-advocate of a military court. A knowledge of military life is only possible to one who has spent a great part of his existence in practicing it, and it would be many years before the lawyer could acquire that intimate knowledge of the customs of the service, and of the rules, orders, etc., which regulate the daily life of the soldier and which must be taken into account in substantiating causes.

[Practical Observations on Military Justice. By Luis R. Quiquisola. *Rev. del Circulo Militar,* Jan, '17. 2500 words. (Continuation.)]

From what has been set forth it must be evident that the judge-advocate should be a military man, who by special preparation has become well founded in the principles of law and legal procedure.

This conclusion is confirmed by the learned Doctor Bustille, publisher of "The Code of Military Justice," who states in the fourth edition of his work that "The introduction of civil lawyers in military cases, far from being a benefit, has in many ways been a positive disadvantage." Also: "The limitation of the detail as J.-A. for one year has been of no practical value as a measure for educating all officers in this duty, and the administration of military justice has suffered thru it."

The spirit of independence so necessary in the exercise of the judicial function can only exist where the judge is secure against arbitrary removal, and this is just as important in military as in civil courts.

There are many officers in the army, active and retired, who, if assured of a degree of permanency, subject, in fact, to removal only for exceptional causes, would undertake this duty as a true vocation, and by diligent study and conscientious work would soon add to the prestige of military courts.

The J.-A. should have rank commensurate with the dignity of his office, and if he be an officer on the retired list he should have a small increase of pension, or his services might be counted in computing longevity pay.

The Secretary to the Judge-Advocate

Recent orders provide that in each division (army) there will be two permanent secretaries for the J.-A. This is a step in the right direction.

The secretary should be a real assistant and collaborator, not a mere clerk. He should be able to formulate and present his views to his chief and to discuss with him the issues involved. This requires that he possess a good education, a knowledge of the military code and the general principles of law, and an inherent aptitude for his duties.

Here again a retired military official would be best fitted for the task and should be given a small increase in his pension as a just compensation for the additional duties performed and as a stimulus to effective work.

As the secretary has the same expenses when traveling, he should have the same allowances as the judge-advocate. The present allowances are not sufficient to meet actual expenses of travel, hotel accommodation, etc., and should be increased so that both might live in a manner becoming to officers of the Argentine army.

LEE-ENFIELD RIFLE

[The British Lee-Enfield Rifle. *Army & Navy Jour.,* May 19, '17. 550 words.]

The 1914 model of the British Lee-Enfield rifle which is to be used by the American Army is compared to the United States magazine rifle as follows: It is heavier, weighing nine pounds and five ounces against 8.69 pounds weight of the American rifle; length of barrel Enfield, 26 inches, American rifle, 24 inches. The Enfield is loaded by a charger holding five rounds. No cut-off is provided. The sighting arrangements are held to be superior to those of the United States magazine rifle. The foresight is an adjustable blade protected by two wings. The rear sight is provided with two apertures, one of which is used when the sight is upright and the other for use

when the sight is flat. The leaf is graduated for every hundred yards from 200 to 2000. The slide can be adjusted for every 50 yards. In general appearance the British rifle resembles the American, and the method of loading and firing is practically the same.

[Enfield Rifle to Be Used by Army. *Army & Navy Jour.*, May 19, '17. 1000 words. Quoted.]

Following is the statement of Chairman Scott of the General Munitions Boards:

"We are in a position now to assure the country that rifles and ammunition will be ready for American troops as fast as they can be raised and otherwise prepared for foreign service. There are on hand more than enough rifles for the rifle-carrying men of an army of approximately a million, and arrangements have now been made to provide for the arming of a larger force, and for the reserve which the wastage under modern war conditions makes necessary. Plans have been completed to take advantage of the small arms factories developed in our country as the result of the European war, and convert then to our use. In addition the Government arsenals are being expanded. In general, it may be stated that small arms, including ammunition, can be provided for practically any number of men that the country may call to the colors.

"Manufacturing facilities for the Springfield rifle are not adequate to supply the number required for the larger force which the United States may decide to send abroad and to replace the wastage of such a force. Fortunately the existing small arms factories which have been turning out quantities of rifles for the British army are equipped to manufacture the Enfield rifle in more than sufficient number. Therefore, it has been decided to adopt the Enfield rifle, but manufactured to use American ammunition, and to issue these rifles to our troops to such an extent as may be necessary. Our Government will continue to manufacture the Springfield model, the ammunition for which will be interchangeable with that of the new Enfield.

"The United States is in a very satisfactory position so far as all types of ammunition are concerned. The country has developed during the last three years great plants for the manufacture of high explosives, small arms ammunition, and field artillery ammunition of various types. This development has been so great that several of the belligerent nations have received the greater part of their supplies from us. New plants have been developed in the interior of the country where they are safe from any raiding parties that might land upon the coast. The supply will be such that the United States can take advantage of it without taking needed ammunition from our allies.

"Steps are being taken to provide for the additional quantities of field artillery necessary for modern battle conditions thru the extension of plants already in operation for the Allies, and thru the introduction and adaption of new plants that have not hitherto manufactured war material. The process will be slower than that of providing rifles, but this country has been noted for its machine tools, an industry which has been developed beyond that of any other nation, and this is proving a decided asset in these days of preparation of a great war and will help us to make good a shortage which is greater than it should be. The General Munitions Board is endeavoring to develop these various resources to the fullest capacity in order that the country may be prepared for any developments of the military situation, no matter how serious they may prove.

"In order to secure the great quantities of artillery immediately necessary for the large armies that are to be raised, a certain number of guns of tried foreign types, but manufactured in the United States, will be introduced into our Service. Satisfactory arrangements have been made to accomplish this. In the meantime the munitions plants are pushing forward their preparations for the manufacture in large quantities of the various types of mobile artillery that have been adopted for our own Service. Among these types is the 3-inch light artillery gun, of which the latest model is said to be even superior to the famous French 75."

LEE, Robert Edward

[Robert Edward Lee. By Maj. Wildurr Willing, Corps of Engineers. *Professional Memoirs,* July-Aug, '17. 6000 words. Illustration.]

(A short but fairly complete biography of the great Confederate leader, with brief descriptions of his campaigns.)

LEWIS MACHINE GUNS

See

MACHINE GUNS—UNITED STATES

LIBERTY MOTOR

[The Liberty Motor. *The Independent,* Sept 22, '17. 330 words.]

The "Liberty Motor," which is the aircraft engine designed for America's aerial fleet, has passed its final tests. One of the engines in an airplane broke the American altitude record in a flight test. In lightness, power and convenience, the engine is said to be equal to the best European models and it is better adapted to building on a large scale. The British and French machines require much handwork from skilled mechanics for their construction, but the American motor is so standardized that its cylinders, pistons and other parts may be made in factories in widely separated parts of the country and assembled at a central plant. The parts are so readily interchangeable that new engines can be assembled from the parts of wrecked machines, thus greatly simplifying the problem of repairs. The motor is the invention of two prominent American engineers, who had at their disposal the secret patents of motor manufacturers.

LIFE SAVING SERVICE

See also

AERONAUTICS—USE OF IN LIFE SAVING SERVICE

LIMBS, ARTIFICIAL

See

WOUNDED—APPLIANCES FOR

LINDSAY ARSENAL

[The Lindsay Arsenal. *Canadian Military Gazette*, Aug 28, '17. 300 words.]

Many new wartime industries have been started in Canada. Among these is the arsenal at Lindsay for the manufacture of small arms ammunition, modern, up-to-date and complete in every department. The place is unpretentious in appearance, the shops being one story in height, of brick and steel. The plant is fireproof thruout. To guard against lightning, every machine is grounded. The shops contain hundreds of special machines, a gas plant and annealing ovens, a 600-yard underground testing range, and a 180-yard range for experimental work.

LINES OF COMMUNICATION

See also

ROADS, MILITARY

MACHINE GUNS

See also

AERIAL ARTILLERY
AERONAUTICS—ARMAMENT FOR AIRPLANES
COLT-MARLIN MACHINE GUN
INFANTRY—ARMS—RIFLE—AUTOMATIC
INFANTRY—TACTICS—COMBAT (Article: "Organization of the Infantry Battalion. New Armament and Tactics")
NIGHT ATTACK (Article: "Remarks on Night Firing with Machine Guns")
RAPID-FIRE GUNS

[Characteristics of Machine Guns. By Capt. J. J. Dooley, M. C. Reserve. *The Marine Corps Gazette*, June, '17. 3000 words. Illustrations.]

In the use of machine guns, two features stand out: the task to give them, and what assistance to expect from them. They showed their worth first in the Boer War, next in the Russo-Japanese. When the present war broke out, the Germans had 50,000 of them, and have since, so it is believed, increased this number to 200,000.

There are two types of machine guns: the recoil-operated (Maxim), and the gas operated (Lewis). All authorities are agreed in believing that tactically the machine gun should give close support to the arm to which it is attached. No matter how good the piece may be mechanically. it will fail if not used correctly in a tactical sense. Hence it is necessary to understand its characteristics. First we have the characteristic of rest. With a mount, one man can do the actual firing, and the grouping of shots is far superior to that of infantry fire. If the first shot can be spotted, all the succeeding ones count heavily, and the personal factor thus largely eliminated. It is one man, one hold, one gun, against many barrels and many holds, all of which vary. Close grouping means the ability to concentrate fire in a crisis. Furthermore it is easier to observe and correct machine gun fire than it is to do the same thing for rifle fire. The machine, in night fire, is easily superior to rifle fire.

Speed of fire is another characteristic. One machine gun is said to be equal to the fire of fifty rifles, firing rapidly. Shift of targets is far easier. From a narrow front and shallow depth a large volume of fire can be delivered. The machine gun offers a small target to the enemy's fire. Whether light or heavy, it carries its equipment and ammunition with it, and is a self-contained unit. It may be carried by pack, wagon, or truck.

At times it will jam. We should not forget that it is a machine, and like any other machine, resents careless treatment, such as lack of lubrication and improper feeding. But these sources of troubles can be corrected by proper drill. Other sources are broken springs. extractors, etc. But here, proper drill will enable the men to make quick repairs.

The noise of the machine gun is characteristic, but if much other firing is going on at the same time, this trouble is to a certain extent neutralized. A machine gun is more easily located by the sound of its firing when in the infantry firing line, than when on the flank of that line.

United States

[War Department Ready. *Army & Navy Jour.*, Apr 21, '17. 700 words.]

It can be officially stated that the War Department now has on hand all the necessary supplies for an army of 500,000 men, with the exception of heavy ordnance and machine guns. Thirteen hundred Lewis machine guns have been ordered from the Savage Arms Co., and 1700 more will be ordered when funds are available.

[New Machine Gun Approved. *Army & Navy Jour.*, July 21, '17. 300 words.]

The Machine Gun Board has recommended the immediate purchase of 20,000 Browning machine guns, half of the light and half of the heavy type. It is reported that one Browning rifle fired 4000 rounds without stoppage or jam. Very little is known about the gun except the name of the inventor. The Colt Firearms Co. controls the patents. The Board has also recommended that 25,000 Lewis guns be procured.

The War College Division favors at least eight machine guns to the regiment, operated by two machine gun companies of four guns each.

—Drills and Drill Regulations

[Contribution to the Revision of Our Regulations for Infantry and Machine Guns. By Capt. Maillard. *Memorial del Ejército de Chile*, Apr, '17. 2800 words.]

The regulations for infantry and machine guns were translated from the German Infantry Regulations of 1906, with changes to 1909 inclusive.

The Prussian Minister of War proposed subsequent changes which were approved by the Emperor in 1910,

1911 and 1912. The regulations are different to this extent. There are also errors and omissions in the translation. The purpose of this article is to indicate clearly the modifications introduced in Germany and also the before mentioned errors and omissions that occurred in the translation. The recommendations is made that the regulations be kept up to date by means of printed changes so arranged that they can be pasted in opposite the corresponding paragraphs.

—Erosion

[The Erosion of Machine-Gun Barrels. *Scientific American,* Nov 18, '16. 500 words. Illustrated.]

Thru the courtesy of the Chief of Ordnance, U. S. A., a number of photos are reproduced. They show erosion of barrels after varying numbers of rounds fired continuously, with and without water cooling. In the latter case the erosion is much more severe. In one case without water cooling, the bullet went out thru the side of the barrel after 725 rounds. Other views show not very severe erosion after 5000 rounds with water cooling. The erosion starts as a pitting at the seat of the bullet, and gradually extends with long continued firing into pits or regular channels for several inches down the bore.

—Field Use of

[Machine Guns in Battle. By a French Expert. *Infantry Jour.,* Oct, '17. 6200 words.]

The machine gun is a repeating rifle of great efficiency which fights only with its fire. Machine guns cannot be used as substitutes for artillery or infantry, but should be used in connection with other fighting forces. The present tactical unit of combat is the company of four sections; the fighting organization is the section of two pieces. The great value of the machine gun lies in the accuracy of its aim, the shape of the sheaf of bullets, and its rapidity of fire, all dependent upon the construction of the gun and instruction of the personnel.

The useful effect of a plain bullet lies in its force of penetration. Ricochets often have sufficient penetrative powers and they contribute largely to the moral effect upon the enemy by their peculiar noise.

Their invisibility and mobility, the small front required for going into action, and the facility of directing their fire are qualities peculiar to machine guns. Their action is either destructive—firing to kill; or fire maneuvers—neutralizing opposing fire and demoralizing the enemy. They can absolutely prohibit a zone to the enemy, positions or shelters occupied by troops are rendered untenable by sustained fire, and the noise of machine gun fire has a demoralizing effect on the enemy.

The tactics of machine guns consist in choosing methods which will secure the aforementioned effects, what assistance they can render the unit to which attached and how they shall be placed in order to secure the best advantage of their firing capacity. Machine guns must not be regarded as a reinforcement or firing reserve.

The fighting organization must be based on confidence, solidarity, discipline and cohesion. Team work secured by frequent maneuvers is important. The formation for advance should be the object of special instruction in machine gun units, which can be used on all ground that is practicable for infantry. Machine guns are gotten into position with caution and then disclosed suddenly with a crushing fire. The reconnaissance of a machine gun section is of great importance.

The field of fire should be clear, extended and well oriented. Machine guns should be placed so as to enfilade any formation which may appear in the field of fire. Flanking positions for machine guns give the best flank protection. There should be no dead angles in the field of fire. In order to escape from the enemy's artillery machine guns should not be placed in positions that are easily picked up and ranged on; when a machine gun has registered its fire it should be moved to another emplacement; and shelters which are proof against large caliber shells can be used for machine guns and their crews.

The fire direction is a function of the section chief who communicates to his gunners the target, kind of fire, etc. Emplacements must be chosen, in advance, to which the guns may be moved as the objective changes.

The kinds of fire to be employed are: (1) series firing—so many rounds or belts; (2) variable; and (3) intermittent firing. Fire with gun unclamped to sweep open fields, with the gun clamped to cover special points—obligatory directions of approaches for the enemy.

Against massed formations the fire should be such that the objective will be kept under the action of the sheaf as long as possible. Against an advance in thin lines machine guns in great numbers using an unlimited or free fire are most effective.

The section chief must act according to the occasion and the nature of the battle, and be in intimate communication with his captain. He must prevent the enemy from making use of his weapons or compel him to show himself.

—Fire

See also

Cavalry—Fire—Target practice

(Article: "Interesting Firing Exercises with Carbines and Machine Guns against Aerial Objectives.")

—Materiel

United States

[Report on Machine Rifles. *Army & Navy Jour.,* Nov 18, '16. 2000 words.]

The Machine Gun Board considers that a field test, including airplane tests, should be conducted after the ballistic and endurance tests. The Springfield Armory is best equipped to make the ballistic and endurance tests.

A total of 8015 heavy type and 9268 light type machine guns will be required for the Army and National Guard as now authorized.

Previous machine gun tests are cited. In 1903, exhaustive tests resulted in a recommendation in favor

MACHINE GUNS—Continued

of the Vickers-Maxim. A board in 1908, after testing the Benét-Mercié, reported favorably upon it. A supplementary test at the School of Musketry confirmed this report. In 1913 a board considered the Lewis gun as not superior to the service automatic machine rifle on account of broken parts and jams, and reported the Vickers light model superior to the service automatic rifle. In 1914, a board conducted field tests in elaboration of the 1913 board, and recommended the Vickers light model. In 1916, a board was convened to test the Lewis machine gun. It reported against the purchase of four guns chambered for service ammunition, but recommended that the Savage Arms Co. undertake to develop a gun for service ammunition. Another board convened in 1916 reported the Colt gun superior to the Lewis gun for general service use. All of these boards were convened by War Department orders. A test of the Lewis and Benét-Mercié guns was made in 1916 by a board convened by the department commander, Eastern Department. It reported the mobility of the two guns the same but "the superiority of the Lewis gun in every particular was clearly demonstrated." In a test at Indian Head, July 26, 1916, the Lewis gun jammed frequently. It was said to be a good gun but not completely developed.

—Motor Transport of

[Motor Machine-Gun Defense for U. S. By Major M. J. Phillips. *The Power Wagon*, June, '17. 1800 words. Illustrated.]

Machine guns mounted in armored motor cars have proven a failure in the European War. Trench fighting offers no chance for patrolling, skirmishing, or any of the other uses for which the machine gun carrying armored car would be valuable. In addition the airplane reveals their movements.

However, the conditions in the United States are very different, and motor machine guns would render important service in defense. Experiments have been made on the Mexican border to develop a suitable type. Three kinds have been tried: (1) A light type carrying two machine guns and crews. They could not negotiate the difficult road conditions of the border; (2) A genuine armored car with high-powered reliable motor. It had bullet proof armor and carried six men and three guns. It was too heavy, too conspicuous, and the center of gravity was too high for maneuvering in broken ground. (3) The best type was found to be an open car about the size of a seven-passenger touring car without a top. The body was bullet proof and divided into compartments for guns, fuel, ammunition. etc. Its real use was to transport machine guns rapidly to strategic points, tho the guns could be used from the car. Each car costs about $4000 and carries eight men, four machine guns, and necessary accessories.

(A scheme for coast and border patrol, using a total of 1280 cars and 15,000 men is proposed. Roads are to be constructed where necessary. The defensive frontier is divided into 25-mile sections, each patrolled by four motor machine guns. One thousand machines are proposed for a reserve.)

[Note. *Army & Navy Jour.*, Aug 18, '17. 100 words.]

Ordnance experts consider the motorcycle side-car machine gun and armored motor cars carrying 3-inch or larger guns to be impracticable under the present conditions of trench warfare. Great reliance was placed in these during the early part of the war.

—Tactics

See also

Tactics (Article: "Modern Battle Tactics")
Tactics—Offensive vs. defensive (Article: "The Passing of the 'Pill Box'")

[Machine Guns—Their Importance and Action in the Defense of Fronts. By Capt. Andres Aguirre. *Mem. de Infantería* (Spain), Nov, '16. 2500 ords.]

One of the many new developments of the present war is the greatly extended use of machine guns. While all modern armies have been provided with these guns and have formulated regulations for their use, only a very limited number even within military circles were aware of the tremendous possibilities of machine gun fire as developed in the present struggle.

Within its sphere of action there is no arm so effective, and none that fulfills its function in battle with the same certainty and efficacy as on the practice grounds in time of peace.

The battery, thó using the proper projectile, cannot undertake definitively to cover its target with a fixed number of rounds within a limited space of time, nor can the infantry, however skillful its shooting may be, assure definite results.

The battery commander with known ranges can insure the proper direction and even a normal explosion, but the flight of the bullets after the burst cannot be regulated.

In the infantry, some are good shots and some are poor, and if the soldier is nervous or suffering from fatigue, the value of his fire will be impaired.

With the machine gun, on the other hand, after bracketing the front of the target with two shots and determining the density of fire to be employed, the gun can be traversed within fixed limits with absolute certainty of covering the target.

The machine gun is particularly effective for trench defense. Having been assigned a certain front to be covered, it is only necessary to plot the range to different objectives, calculate the density of fire necessary to establish a curtain of projectiles in front of the section to be defended, and determine the horizontal and vertical limits within which the gun is to be traversed. Frequent exercises should then be had in pointing and serving the gun to meet the different situations which may arise.

Following the bombardment, when the hostile infantry begins the advance, the group captain places his guns in position, assigns the fronts to be covered by the different sections, announces the range, orders the kind of fire, number of shots, etc., and awaits the propitious moment for opening fire.

Even if the hostile bombardment has been unusually severe and effective, it is generally possible to main-

tain machine guns and the detachments to serve them in subterranean shelters after the first line troops have been withdrawn to the rear and concentrated under cover for the counter attack.

These small detachments, confident in the efficacy of their weapon, will be better disciplined and more easy to control than large bodies of Infantry, and the fire of two machine guns can be more readily controlled and corrected than the fire of a hundred rifles.

(Here follow comparative tables based on practical tests showing the relative efficiency of the machine gun and a body of infantry firing at a target under like conditions.)

[Machine Gun Sections in the German Cavalry. (Reprint from a Spanish publication) *Revista Militar,* Jan, '17. 3000 words.]

In the reorganization of the cavalry a machine gun detachment is provided for each brigade. Cavalry masses so equipped are greatly augmented in fire power. The fire of a group of 6 units is equivalent to that of 400 carbines. How many squadrons must be assembled to put this number of rifles on the firing line? The fire of machine guns enables cavalry to maneuver mounted and therefore to utilize its mobility and shock action. Germany has had great success with her cavalry, both as cavalry proper and as foot troops. The resisting power of the accompanying artillery and machine guns was always made use of to the fullest extent.

A cavalry division in attack places a machine gun group on each flank and holds one in reserve. Group commanders are carefully oriented as to the situation and the plan of the commander. They are connected with him by telephone or by relays of mounted messengers. When established in position, the groups open a heavy fire upon the targets assigned. If well placed they are able successfully to oppose any flanking movements. If the enemy is defeated they pursue with fire up to the limit of machine gun range. In case of defeat the groups have a very important rôle. They contain the enemy, opposing him with a curtain of lead while their own troops are reorganizing. The fire of machine guns is so accurate that it can be directed just over the heads or only 10 meters to the flanks of firing lines. Realization that the sheaf of fire is so close does not intimidate the men but rather strengthens their morale. The German doctrine is to concentrate the fire of all six units upon one objective at a time, the idea being to overwhelm each target with fire successively.

The latest impressions received about the use of machine guns with cavalry may be summarized as follows:

1. An audacious cavalry may perform great feats if the machine guns are used properly. A high degree of training and discipline is presupposed. Exceptionally able group commanders are necessary.

2. The machine gun group has nothing to fear from hostile infantry; from cavalry, nothing, except when surprised and charged from various directions. The dangerous enemies are the hostile artillery and machine guns.

3. Detachment commanders must be men of unusual initiative. They must not fear to accept responsibility. They must be accustomed to working without support from other troops.

4. All troops now must have machine guns. Cavalry needs them more than any other arm.

—Troops—Organization

See also

GERMANY

["Machine Gun Units." *Memorial del Ejercito de Chile,* July, '17. 300 words.]

Each regiment of the German infantry has a machine gun company. Each machine gun company has sixteen guns, and consists of one Captain, two Lieutenants and two hundred men. A Lieutenant of Cavalry is in charge of the horses. There are thirty-five horses; five for officers (the captain has two), eighteen for the machine gun carts; twelve for baggage and supplies.

There are nine guns carried each on a cart, the remaining seven being held in reserve on the supply wagons. Each cart transports twenty boxes of cartridges, totalling seventy-five hundred cartridges.

—Use of in European War

See also

TACTICS—OFFENSIVE VS. DEFENSIVE (Article: "The Passing of the 'Pill Box'")

[A Study of the Employment of Machine Guns and Barbed Wire in the European War. By Captain Henri Carré. *Revue des Deux Mondes,* Oct 15, '16. 1000 words.]

One of the revelations of the war has been the extraordinary effectiveness of machine guns and barbed wire combined. Together they constitute the most frightful barrier that an offensive, however determined, can face.

The French are at present using mainly the Saint-Etienne mitrailleuse, the Puteaux mitrailleuse, and the Hotchkiss machine gun, model of 1914.

The problem of machine gun transportation is of vital importance. Efforts have been made to work out the best solution, so that the weapon can be taken and used by infantry, wherever it may go.

On roads, and in well defiladed zones, the machine guns, with their combat (or initial) ammunition supply, are carried on pack-saddles or in small wagons or carts. When under fire, or in case of danger, the packs or carts are unloaded, and the elements are carried by the men, on their backs or in their hands. The guns must then be assembled for use.

Four hundred shots per minute seems a desirable maximum. There is no tactical reason for a greater rate, and firing longer than one minute upon the same objective is rarely justified. At the rate of 400 shots per minute the attempt should be to obtain a cadenced rate of seven shots per second.

The machine gun is really a semi-portable deadly light engine, whose service requires a limited person-

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nel; it therefore permits economy in the use of men on any particular front; and that is one of the reasons it has found such favor with the Germans. In position, the gun has but slight visibility, and is easy to conceal completely. It betrays itself, on the other hand, as soon as it enters into action.

Altho of complicated mechanism, the guns now in use do not easily jam; certain delicate parts may be broken while firing; but as spare parts are available and ready, a trained personnel can make any necessary repairs in a few minutes; it is merely a question of thoroly trained men.

The German gun, a Maxim model, is distinguished by its cooling system, its rapidity of fire, and its manner of transport. After 6 or 8 hundred shots, the water in the cooling jacket begins to boil. This fact interferes with the firer, and reveals the location of the piece, unless the steam is made to escape into water or toward the ground. The Germans have utilized this peculiarity of their gun to give the effect of the presence of machine guns where none existed.

Their guns have a method of transportation different from the French. No packs are used. All the matériel is on wagons or machines. The gun when assembled rests on a socket which slips on to a rest fixed on a caisson or an automobile. The bolt seen mans in time of peace, it has developed, had been prepared for the reception of machine guns. In their machine gun companies, officers and non-commissioned officers are mounted; the caissons can take the gun servers forward at a trot, leaving the ammunition servers temporarily behind. The German idea has been to get their machine guns into action quickly, and to have them precede their infantry when so desired.

In the zone of fire, the gun, always mounted on its carriage, is transported on the shoulders of one man (weight 55 kilos), or by two men in a hand-barrow, or by the three servers, dragging the machine on the ground. The carriage which has a curved front, making it look like a huge insect, is adapted to this last method of progression, even over difficult ground. Certain guns are provided with chains to permit of hand transportation.

When the German mobilization took place, their numerous machine gun units were completely organized, either as regimental companies or as division companies. The Germans took the field with thousands of machine guns. The great number of these weapons was one of the elements of their superiority. They excelled in concealing the guns behind hedges, walls, in haystacks, etc., and in masking the muzzles to hide the flame of discharge. Since, the multiplication of these weapons has enabled them to a certain degree to make up for the losses in human material.

The machine gun soldiers are carefully selected and methodically trained. They have instilled into them the idea that their weapon is invincible on the defensive. The bravery, coolness, audacity, and skill of the machine gun soldiers all contrast with those qualities as exhibited by their bomb-throwers.

It is now accepted that machine guns must be used for covering infantry both at short and at long ranges: they prolong, in a way, the action of the artillery, tho operating very differently.

To aid an infantry attack, therefore, as many machine guns as possible should be engaged.

In addition to those covering or supporting the infantry attack, other machine guns should accompany the assaulting troops, and be ready to hold the first position so as to facilitate the progress of the infantry to another. The position the machine guns should take in accompanying the assaulting troops, is a difficult problem to solve. Altho they should get into action as quickly as possible, it seems very dangerous to have them in the first assaulting wave; the best place for them would seem to be behind the second or third wave.

Upon the defensive the machine guns should not all be placed on the first line, to which the ranges will be too carefully determined by the enemy. It is advantageous to arrange them in depth, and preferably at every salient, so as to take assaulting troops in flank. The Germans almost always have them arranged for flanking fire. Their prisoners often speak of *machine guns of position,* mounted on fixed carriages, and independent of those belonging to units.

At present, there is a tendency on both sides to install the guns only at the moment of combat, and upon the parapets of the trenches themselves. When not needed the guns are kept carefully sheltered, to be brought out in case of attack and thus avoiding the construction of shelters having a visible relief, which can be ranged out and destroyed.

Loopholes also greatly restrict their field of fire. German machine guns have been found, in captured positions, sheltered at a depth of eight meters, with an elaborate elevating system of inclined planes and cables.

To minimise the effect of heavy explosives, the Germans have built extraordinarily deep and solid shelters. One new type is arranged for two groups of nine men each with re-enforced walls and ceilings. Flights of steps reach these subterranean rooms, and ropes and pulleys enable the guns to be brought up for use in a few seconds. Often some guns remain concealed, till the first attacking wave has passed over their heads, when they appear and take the attackers in rear; hence the English dictum "Clean out the trenches!"

Elevating systems have been extended to include elevators, which will instantly hoist men and machine guns. All this machinery explains the length of time that attacks have been held in check. Again and again assaulting troops, tho their attacks had been thoroly prepared by heavy artillery, have been subjected to the deadly fire of the German machine guns, appearing and disappearing like Punch and Judy.

In villages, machine guns fire from house and cellar windows, with terrific effect. In the village of Pozières (of about 400 inhabitants) there were no fewer than 200 machine guns, of which 30 remained intact after 48 hours of artillery bombardment. At every turn

of the subterranean meanderings in the village, maxim guns unleashed their deadly fire. They had to be destroyed one by one with hand grenades. It has been found that nothing save squads with hand grenades, working thru the tunnels and the crater caused by heavy shells, can destroy these guns; the operation is difficult and dangerous, and always costly.

It was on account of these hornet nests that the British devised the so-called "tanks." It is the inauguration of a new kind of tactics, of which the importance will go on increasing, the combat of the protected mobile machine gun against the machine gun of fixed action. Machine guns are also being used in aeroplanes for firing upon infantry.

Wire of all sorts and of all thickness is used in the present war. On the Italian front, wire as thick as one's little finger has been found protecting certain Austrian defenses. At Pozières fragments of wire were collected that consisted of five strands, braided barbed.

The establishment of a regular net-work necessitates the planting of low posts or stakes driven as solidly as possible into the soil. Wooden stakes being easily destroyed by artillery fire, they have been supplanted sometimes by iron stakes provided with rings. Such a system can be established only when distant from the enemy; the driving of the stakes, even with muffled hammers, makes a noise which reveals the operation, with fatal results. Therefore in front of the first lines, the installation is limited to that of improvised net works, which must be put in place at night, and often under fire.

In this case use is made of spirals that can be instantly unrolled, or of "bird-traps," placed in juxtaposition and fastened togeher,—a kind of polyhedron, made in rear. The edges consist of four sticks fastened together with wire, the whole being portable, and easily put in place. When the hostile lines are close together, their wire defenses come in contact, and form one uninterrupted obstacle. If one side attacks, it must clear a way thru its own system while destroying that of the adversary.

Behind the first lines, still stronger systems of barbed wire entanglements are found. They have been constructed under better conditions as to time and shelter. Attacks which have broken thru the first line have been checked by these stronger barriers in rear, which have partially escaped destruction by artillery fire. Networks on counter slopes are particularly dangerous because of their invisibility.

The Germans have numerous communicating trenches staked with wire on both faces, for the purpose of defense against enveloping attacks, or to admit of defense in two opposite directions.

It has been observed that in the extraordinary complications of entanglements found about the trenches, in communicating trenches, and saps, along roads, etc., the defending troops are to some extent imprisoned in their own works. Flight being almost impossible, mediocre troops can be used in defense. The German brain has probably not overlooked this fact. At any rate the use to which wire entanglements has been put is astonishing. In the Trônes Woods, which the English took after a bloody struggle, foot by foot and from tree to tree, one might say that teams of skilled poachers had been used to cover the surface with man-traps. The spider webs of wire were attached to the trunks and even to the roots of the trees.

Since the wire is an insuperable obstacle to infantry, it must be destroyed before the attack, or at least passages or openings must be made. It can be done by squads of men who crawl to the wire and cut it, or place explosives in it. This method is extremely dangerous, and even when cut the fragments of wire constitute a serious obstacle. Grappling irons have been tried, but proper apparatus is difficult to install, and even when the wire is caught and pulled loose, it usually happens that the cable breaks or the windlass slips or that one only pulls nearer to his trenches a mass of wire more entangled than ever.

The only practical method of destroying wire is by perfectly directed fire with explosive shells. The stakes are broken up, and the wire pulverized. This requires an enormous expenditure of ammunition, a consideration of no weight in these days. Even this method does not entirely free the ground of the wire, so with the first attacking wave are men who are detailed to cut the remaining portions of the wire. The British now use a sort of fork, with two branches of flat steel with cutting edges, on the end of the rifle, for cutting or pushing aside the wire.

In their offensive on the Isonzo, the Italians seem to have inaugurated a new system of destroying the wire with trench bombarding engines, instead of by long range artillery fire. This method of throwing enormous shells loaded with huge quantities of high explosive from a distance of only a few hundred yards has surpassed all expectations. The British are also using accompanying mortars, which throw big spherical bombs (plum-puddings), and because of their plunging fire permit destruction of wire on counter slopes.

The Germans have put wire to strategic use, particularly on the Russian front, where enormous spaces have been staked with it, thus permitting the use of comparatively few troops, provided with enormous numbers of machine guns, to hold long stretches of ground, while the main forces are free to be thrown quickly from place to place as needed. In many places these net-works of barbed wire are six kilometers in depth. Thus by economizing men, which they replaced by material (barbed wire and machine guns), they covered their strategic movements and were able, during the course of 1915, to obtain numerical superiority even over the immense Russian armies.

Barbed wire and machine guns make a terrible combination. One of the most tragic spectacles of the war is that of a force entangled in the meshes of wire and subjected to the deadly fire of concealed machine guns. The men are literally mown down, or remain hanging to the barbed wire. Even more than heavy artillery does this combination delay, break up, and paralyze the best prepared and best conducted attacks.

In the last phase of the attack on the Delville Woods, in the combat of machine gun against machine gun, the Lewis machine guns of the English consumed 999,500 cartridges in the space of 12 hours. A report found

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on a captured German officer spoke thus of the English guns: "The British infantry is extraordinarily stubborn on the defensive; it is extremely difficult to dislodge even the smallest fraction once it has got a footing with machine guns in the corner of a wood or in a group of houses."

In the huge agglomeration at Combles, at once an arsenal and a fortress, every house was a redoubt, every cellar an ambush of machine guns.

Our experience has been costly, but we have drawn from it very valuable information for future operations. We know today that however prolonged, precise, complete and implacable is the necessity of establishing the most powerful means of destruction obtainable, it is not in vain thus to prepare the destruction of the enemy's machine guns and barbed wire for the advance of our infantry.

It is by thus economizing French blood that we shall be enabled to continue the long, patient effort involved in the phases of battle yet to come.

[The War of Specialists—The Machine Gunner. By Capt. Louis Keene, C.E.F. *Scientific American*, Aug 25, '17. 1800 words. Illustrated.]

The automatic machine gun was invented in 1883. Its value was shown in the Russo-Turkish and Balkan wars, but the Germans alone profited by this experience. They provided large numbers of guns and organized a separate corps for their service. A well served machine gun is worth 100 riflemen and is even more effective when flanking barbed wire.

So effective are they that neither side hesitates to turn a battery of artillery or even heavy guns on a spot suspected as a machine gun emplacement, and the tanks were specially designed to overcome them.

Machine guns are served from concealed positions and usually fire to a flank. Their position must be changed frequently. The Lewis gun is a light gun used to accompany infantry.

MANEUVERS

See also

MARCHES AND MARCHING

MAPS AND MAPPING

See also

SIEGE ARTILLERY—MAPS FOR

[European War Maps. *Geographical Review*, July, '17. 1800 words.]

(Two classes of maps are discussed—general maps of scale approximately 1:1,000,000 and detailed maps of scale roughly 1:100,000. Those available by purchase for individual use in studying the war are described very briefly and name and address of publisher is given, but not the price. It is stated that "the 1:80,000 black-and-white map of France, altho the standard, has been omitted because of its illegibility.")

United States

[Note. *Army & Navy Jour.*, Feb 17, '17. 200 words.]

Owing to the increased co-operation between the United States Geological Survey and the War Department, a Division of Military Surveys has been created to meet the requirements of the army in collecting special map data desired by the War Department.

—Aeronautic

[Aeronautic Maps. By G. L. Cabot. *Flying*, Feb, '17. 920 words.]

As the gas tank or small pond is a more conspicuous object to the aviator than a church tower, it is apparent that the aviator needs a different kind of map. A congress held in 1913 decided that the scale for aeronautical maps should be 1/200,000 and that all waterways should be painted blue. Special conventional signs were adopted for roads, cathedrals, railroads, hangars, aerodromes and other land marks. It is also desirable for the aviator to have a photographic map of the country he proposes to travel over. Such maps are made by either operating a camera fastened to the bottom of the nacelle by hand or by a camera that takes continuous panorama views. Maps of two different scales could be made by taking photographs from 2000 feet and from 6000 feet. Dangerous landing places which might look good to the aviator should be marked in red; safe ones should be colored green.

[Aeronautical Charts. By Omar B. Whitaker, Sperry Gyroscope Co. *Geographical Review*, July, '17. 1800 words. Two illustrations.]

Misjudgment of landing places due to lack of aeronautical charts has been the cause of many serious accidents since airplanes were able to leave their home grounds. Attention has been concentrated on other developments and this important adjunct has been neglected.

For long cross-country flights, the chart must be formed in a strip about ten inches in width arranged to work on rollers for convenience in use. If the course is meandering, the separate pieces of the chart representing each course should each be provided with a course line with a compass rose every six or seven inches to show the course. On a one-inch map such as the U. S. Geological Survey sheets (approximately), a strip ten inch wide shows five miles each side of the course. The requirements of charts naturally divide them into two classes; one for cross-country and the other for local flights. The cross-country maps are mounted in a long strip on rollers as described. The local maps are square or rectangular with the aviation field near the center.

All aeronautical charts should show the prominent features identifiable from aloft, such as cities, towns, roads, railroads, rivers, landing places, altitudes, fuel and oil supply depots and especially should show swampy areas and other places that would deceive the aviator by being apparently good landing places altho actually dangerous. Means of identifying cities and towns should be used. The use of a standard code of symbols will prevent confusion and overcrowding of charts. Marine charts should show the country two

or three miles inland with points well identified, as the drift due to wind is more likely to be troublesome in over-water flights.

Government and other maps offer a suitable basis for the preparation of aeronautical charts, but much experience and time will be required to put the data in suitable form.

—Map Reading

[On Locating Positions on Maps. By Lieut. H. S. Rowell, R.A. *Jour. Royal Artillery,* Jan, '17. 3000 words. 5 figs.]

In a country where accurate surveys have not been made, or where outstanding features of the land are not easy to indentify, locating a position on the map is difficult.

The simplest problems occur when well defined cross roads, buildings, a river, canal, or railway are near so that a simple offset method suffices. In any case cross roads or other local points of reference may be shown incorrectly with reference to the target area and independent location is necessary. The method commonly employed hitherto is the method of resection—a method of trial and error or successive approximations with the aid of the plane table. This method has disadvantages in the difficulty of using the plane table in a high wind and in the danger of drawing hostile fire when using it in exposed positions.

A new method is proposed in which the angles subtended by the land marks are accurately measured by prismatic compass, sextant, or theodolite at the point to be located. A simple geometric construction on the map under shelter locates the point. If all the points lie on the circumference of a circle, the method fails and another landmark which is not concyclic must be chosen, or an auxiliary point a measured distance from the required point must first be located.

MARCHES AND MARCHING

[Training in Marching. *Army & Navy Jour.,* Feb 10, '17. 900 words.]

Col. Edward L. Munson, Med. Corps, U. S. A., in an article on "The Effect of Marching on the Rates for Non-efficiency of Newly Raised Troops," draws the following considerations:

The march is the greatest of all crucibles for testing the military fitness of men. There should be more training in marching, both for physical development and mental assurance. Marches should be frequent, they should be progressive, they should ultimately be long and comparable to those under campaign conditions.

—Hygiene of

See also

FEET—CARE OF THE

—Speed and Distance

[On the Physiology of the March. By H. G. *Schweiz. Monatschrift aller Waffen,* Sept, '17. 1800 words.]

On good level roads troops can march at the rate of 1 kilometer per 11 or 12 minutes (15 minutes counting the halts), with the full pack. Seasoned troops can march at this rate for ten hours in one day, or for six hours per day on a number of successive days. If the pace is quickened to 10 minutes per kilometer (actual marching) the troops quickly become exhausted. In an article entitled "Physical Strain in Marching and Mountain Climbing," which appeared in *Naturwissenschaften,* no. 19, year 1916, Professor Putter, of Bonn, who was regimental surgeon with infantry in the field, discusses the physiology of the march in substance as follows:

Every muscular activity causes an increased destruction of body tissue, and a corresponding influx of reserve nutritive substances, together with increased consumption of oxygen. This requires increased heart activity. The latter and also increased rapidity of breathing have limits which cannot be exceeded, and therefore if muscular activity makes still greater demands, exhaustion results. The increase in the amount of oxygen consumed per minute forms a measure of the strain caused by any activity. The amount consumed per minute during sleep is taken as the basic consumption, and the degree of strain is measured by dividing the total consumption per minute for any given activity by this quantity. The total consumption per minute is the sum of the basic consumption and the increase due to activity. Knowing the rate at which a soldier can march with the full pack on level roads for long periods, we can determine the possible rate under other circumstances. The science of metabolism teaches that a man 1.7 meters tall, weighing 70 kilograms (average soldier), consumed 250 cc. of oxygen per minute as basic consumption. The resulting combustion produces energy of 1.16 calories or 495 meter-kilograms. Every kilogram carried one meter on a level road at a normal gait of 50 to 100 meters per minute requires .25 meter-kilograms more. Therefore a 70 kilogram man wearing 5 kilograms of clothing must produce, for each meter of travel, $75 \times .25 = 18.75$ mkg. additional energy. Finally, to raise 1 kgm. 1 meter on an inclined road requires an addition 2.8 kg. Therefore the same man, with the same clothing, must produce, for such travel, an additional $75 \times 2.8 = 210$ mkg. The load carried by the German soldier is, including clothing, 31.5 kg., which, added to his own weight, gives, normally, 101.5 kg. As he normally travels 83.3 meters per minute, the necessary energy per minute, on a level road, over and above the basic energy, is $101.5 \times .25 \times 83.3 = 2116$ mkg. This, added to the basic energy, gives a total energy 5.27 times the basic energy. If he travels 1 kilometer in 11 minutes, the total energy is 5.67 times the basic energy. If he travels 1 kilometer in 10 minutes, the total energy is 6.13 times the basic energy. This is excessive.

Professor Putter prescribes rules for climbing slopes which, if followed, will result in a total expenditure of energy 5.35 times the basic energy on the average. He declares that the practicable limit is 5.45 times the basic energy, which, for an infantryman with full equipment, corresponds, on level roads, to a speed of 86.8 meters per minute (1 km. in 11.5 minutes). This corresponds to 2203 mkg. per minute in addition to the basic energy. The slowest practicable rate is

MARCHES AND MARCHING—Continued

50 meters per minute. The energy, in addition to the basic, required for this speed on level roads is, for the soldier, 101.5 x .24 x 50 = 1265 mkg. This, subtracted from the maximum 2203 leaves 934 mkg. for the vertical component of the travel. As already noted, the soldier requires, for each meter of elevation, 101.5 x 2.8 = 284 mkg. This, divided into 934, gives 3.29 meters. It follows that in order to avoid exhaustion at this slowest rate, a road must be chosen, which does not rise more than 3.29 meters in 50 meters. This maximum slope is 6.58 per cent or 1:15.2, and the corresponding speed is 1 km. in 20 minutes. For steeper slopes the pack must be lightened. For slopes less steep the speed can be increased. Putter has constructed a table showing speeds for various slopes, as follows: level, 86.8 m/m; 1:100, 78.1 m/m; 1:50, 70.9 m/m; 1:30, 64 m/m; 1:25, 60 m/m; 1:20, 55.7 m/m; 1:15.2, 50 m/m. The usual slope of modern mountain roads is 1:25, and on new roads nowhere exceeds 1:16.6.

Of the equipment, only the knapsack, tent, and overcoat can be laid aside. The load is thereby lightened 15 per cent. This permits a speed of 1 km. in 10 minutes on level roads, a saving of ½ hour in a 20 km. march. It also permits the minimum speed on a 1:10.8 slope.

—Speed and Distance—Cavalry

[A Cavalry March. By Lieut.-Col. Osvaldo Amieva. *Rev. del Circulo Militar,* Dec, '16. 4500 words. (Continued from November.)]

(A daily record of the service routine of a troop of cavalry on the march. The march covered 780 kms., the return, 390 kms., being made at an average daily rate of 60 kms.)

Conduct of the March. Rules to be Observed. The daily march should begin at a walk; after the first halt the gait should be alternate walk and trot.

A rest halt of ten minutes is made each hour and during this halt the saddle blanket should be folded back and the back hand-rubbed to restore circulation.

Constant watchfulness is necessary to prevent the men lounging in the saddle, throwing the leg over the pommel, etc.

If the men are permitted to mount and dismount in a slouchy manner, the turning of the saddle will soon cause abrasions of the skin.

Before saddling, the hair of the back must be laid smooth and the blanket cleaned of thorns, bunches of hair, etc. The blanket should never be put on while hot from exposure to the sun but first placed in the shade to cool.

When unsaddling, the back should never be exposed to the direct rays of the sun; after hand-rubbing, the blanket should be laid on the back until the horse has cooled off.

Gentle treatment of the horse produces best results; constant spurring, ill treatment or neglect must not be permitted. When the animal is made to feel that the rider is his friend he will move along quietly and without resistance. If unjustly punished or abused, he will become timid and nervous; his digestive functions will become disordered, he will grow thin and poor and end by becoming worthless. Where good croppings are found along the road side, bridles should be removed at the hourly halts and the animals permitted to graze. To avoid dust in hot and dry countries, the troop should move in two columns on the sides of the road, or in subdivisions with sufficient distance to escape the dust.

To conserve the strength of the men and horses and secure best results on the march, constant supervision of all details by the troop commander is necessary. In times of stress or danger, storms, great heat or cold, the commander must, by his example, sustain the men and convince them that he is a leader of strength and character and worthy of their confidence.

The Supply Column.—Pack animals should be employed to transport the rations and baggage of the cavalry. A short calculation will show that this will require no more animals than wagon transportation and will have the great advantage of preserving the mobility of the cavalry under all conditions.

A wagon loaded with 1000 kilos requires eight mules (including three extras for emergencies). A cargo mule will carry 140 kilos and seven pack mules will carry as much as a wagon, leaving one extra for emergencies.

[A Report on a Two Hundred Mile Experimental Cavalry March. By 1st Lieut. E. C. McGuire, 3d Cavalry. *Jour. U. S. Cav. Assn.,* Jan, '17. 1100 words.]

The command comprised one troop of cavalry (one officer and sixty men). The purpose of the march was to test the marching capacity of cavalry when accompanied by motor transportation. Four consecutive daily marches of fifty miles were made. Three 5-ton trucks accompanied the command. The trucks carried the rations, equipment, one-half of the men, and forage.

The plan of the march was to have each trooper ride half the time on horse and half in the motor truck. By this arrangement, each horse was ridden half the distance and led light the remaining half. The march was successfully completed. The daily marching times were twelve hours the first three days and thirteen hours the fourth day. On the last day alternate periods of five minutes mounted at a walk, five minutes at a trot, followed by five minutes with troopers dismounted leading, were resorted to to keep up the speed. The weather was hot and unfavorable, the temperature reaching 112° F. at noon. One horse which had been previously foundered died the second day, and two other horses were foundered but recovered.

The commanding general of the brigade (Brig.-Gen. Parker) stated that "this experiment showed that cavalry is available for (escort and protection of motor trucks) traveling 50 miles a day for a distance of 200 miles" and with more favorable weather for a longer distance. In his opinion auto trucks need the protection of cavalry, and cavalry is rendered much more mobile and effective by motor transport.

MARINES

—History of

[Pipeclay Afloat. Compiled by Col. C. Field, R.M.L.I. (Rtd.). *Jour. Royal United Service Institution*, Feb, '17. 7000 words.]

(An account of the duties and organization of marine detachments in the 18th century.)

—Organization

[Notes on the Organization and Administration of the U. S. Marine Corps. From information furnished thru the courtesy of Hdqrs. U. S. M. C. *Jour. U. S. Artill.*, Nov-Dec, '16. 3000 words.]

Under existing laws, the Marine Corps consists of a specified number of officers and men in each grade. No permanent organization into regiments, battalions, or companies is provided for by law. The organization given it depends upon the service to which the detachment of marines is sent:

The duties of the Corps are:

(a) As marine detachments aboard vessels of the fleet.

(b) As technical organizations for advance base work.

(c) As mobile organizations for supporting the fixed defense forces of advance bases, and for expeditionary duty.

(d) As guards for navy yards, magazines, and radio stations.

(e) Miscellaneous duties.

To perform duties (b) and (c), the corps is organized into provisional companies numbered serially. The companies are combined into higher units as required. Detachments on board ship constitute a part of the ship's fighting force. Each marine detachment mans part of the ship's battery and also is trained for landing duty ashore.

On board ship, the marines use the navy ration; on shore, the army ration. When with the navy they are subject to the naval code, and when attached for duty with the army to the Articles of War. Both the organization and the system of supply are extremely flexible, so that the corps is ready to move on short notice at any time.

MARNE, Battle of the

[The Battle of the Marne. (Extracts from "Psychological Teachings of the European War." By Gustave Le Bon.) By Lt.-Col. Alvelo. *Revista Militar*, Oct, '16. 3100 words.]

This was the greatest battle the world has ever known. It extended over a front of 250 kilometers. The French armies aggregated more than a million men. The Germans were slightly superior in numbers. The battle lasted ten days, from the fifth to the fifteenth of September, 1914. The German losses are calculated to be 150,000 men; the French losses were but little less. General Malleterre states that an account of the individual and collective acts of heroism displayed would fill volumes.

Was not this victory a mandate of destiny, or some grander thing than an act of military tactics? An immense army that thought itself victorious, marching under the influence of triumph was defeated and thrown back by soldiers who had themselves suffered the trials of defeat, retreat, and hunger.

The miracle of the national energy and the warlike virtues of the race were again reproduced. Both Le Bon and Malleterre arrive at identical conclusions. They hold that the victory of the Marne was not the product of a conception of the French higher command—which neither brought it about nor knew when it was won. The salvation of Paris is due to a combination of fortunate circumstances, and to the incomparable bravery and patriotism of the individual French soldier.

MARSITE

[Liquid Oxygen as an Explosive. Anonymous. *Schweiz. Zeit. f. Art. u. Genie*, May, '16. 500 words.]

The lack of nitroglycerine and picric acid explosives has compelled the use of substitutes for commercial purposes. Among these substitutes is an explosive called marsite. Liquid air is first obtained in the usual way and then partially distilled until it contains about 85 to 95 per cent. of oxygen. This is then stored in brass or copper tanks. Cartridges are made up just before use by inserting a small tube of this liquid in a pasteboard cartridge filled with coal dust. One kg. marsite has the same power as 2.2 kg. of dynamite or 6 kg. of powder.

MEASLES

[An Epidemiological Study of an Outbreak of Measles, Camp Wilson, San Antonio, Texas. By Col. E. L. Munson, M.C., U.S.A. *Military Surgeon*, Sept, '17. 8500 words. 8 charts.]

(Concluded from Aug. number.)

(The author was Division Surgeon on the Twelfth Provisional Division, consisting of both Regular and National Guard troops mobilized at San Antonio during the winter 1916-17. In the concluding installment of his paper he considers in detail the medical records of the troops composing the command.

The measles epidemic was confined largely to two National Guard regiments, one of which had one hundred thirty-three and the other two hundred four cases of measles in the period January to March, 1917, inclusive. Among the other regiments of the command the maximum number of cases was sixteen. In all save those showing the extremely high sick rate sanitary regulations were very strictly enforced. This was particularly true as regards the furling of tents and the sunning and airing of clothes and bedding. These precautions were neglected, however, in the two regiments where the disease became truly epidemic.

Basing his thesis upon these data the author proceeds to develop his conclusions.)

Heretofore the results attending measures for the prevention and control of measles have been unsatisfactory. The disease, once started has tended to persist until brought to an end by factors of self-limitation. Now, however, as a result of the study of this epi-

MEASLES—Continued

demic, so much light has been shed on the causation and development of measles as to make its control, except as to scattered cases in individuals, a matter of almost absolute certainty.

It is believed that measles is a thoroly preventable and controllable disease, in recruit depots and barracks as well as in camps. Hereafter the existence of this great cause of trouble to armies in epidemic form should be a reproach to the commander and medical officer concerned, a reflection on their efficiency, and a cause for investigation and disciplinary action.

To the average officer the most important points to be considered in controlling the disease are: early isolation of suspected cases; disinfection of belongings of cases and contacts; abolition of common drinking cups; ventilation, and the sunning and airing of all clothing, bedding and the inside of habitations for at least two hours every fair day.

MECHANICAL TRANSPORT

See

MOTOR TRANSPORT

MEDALS

See

DECORATIONS AND REWARDS, MILITARY

MEDICAL CORPS

See

SANITARY SERVICE

MEDICAL OFFICERS

See

UNITED STATES—ARMY—SANITARY SERVICE

MERCHANT MARINE

See

SHIPS AND SHIPPING (MERCHANT)

MESSES

See also

KITCHENS, MILITARY

MESSINES RIDGE

See

WYTSCHAETE RIDGE, BATTLE OF

METEOROLOGY

See also

WEATHER

MEXICAN BORDER MOBILIZATION (1915-17)

See also

COLUMBUS RAID

—History

[Mobilization on the Mexican Border. *Rev. Mil. Suisse,* Dec, '16. 1300 words.]

After deducting the units detached in the colonies, the strength of the regular army is so small and the units themselves so far from having their regulation complement that the national guard of the different states had to be called out to cover the southern frontier. With that hesitation and that mania for half-measures that characterize President Wilson's policy, it was decided at first to call only the militia of the three frontier states: Arizona, New Mexico and Texas. That is not the cream of our second line army, far from it, if we except the excellent New Mexican field battery, which is commanded by a former Swiss officer. What happened then gave a foretaste of the surprises which the general mobilization had in store for us. Not only was the militia of these three states not ready to march, but a large proportion of militiamen advanced family reasons for not going. It was discovered that many were married, had dependent families, were puny, or were too young, all of these things which it would not have been difficult to find out sooner. In short, this is not at all abnormal with a system of volunteer militia. These units in the United States, are composed of men who, in Europe, would belong to the active, the reserve (or landwehr) and, which is much more grave, to the territorial (or landsturm). While in France and Germany, the soldiers of this latter category enjoy privileged treatment in case of war, in the American militia, they have to march with the active, since there is no distinction. This, as may be imagined, is a very serious drawback, of a nature to compromise the whole mechanism of our military system.

In spite of all the new military laws, the mobilization of the militia is still a complicated operation, for there not only has to be a thorough medical examination of all the national guard, but the oath has to be administered. In this case, this latter formality, on account of recently introduced modification, made things still worse. Militiamen, even entire units, refused to take an oath, the tenor of which was not clear to them. There resulted painful discussions and accusations of cowardice, absolutely without foundation, but not of a nature to increase the prestige of the militia.

The medical examination caused the elimination of a great number of soldiers and officers, some too young or too feeble, others too old and worn out for war service. Bodies of troops thus lost company commanders, colonels to whom they were attached; and a momentary demoralization was produced, very regrettable at the hour of mobilization. These eliminations, coupled with the fact that too many units did not even have their peace complement, retarded considerably the preparation of the troops. It seems that it had been decided, at first, to send to the Mexican frontier only the organizations which had secured their war strength. This could not be adhered to. Some hospital corps organizations and crack batteries were full, but in some of the best regiments of national guard infantry, the discrepancy between the peace footing (diminished by the unfit, etc.), and the war footing, was as much as 600 or 800 men. (War strength of infantry regiment 1836.) And this counting as available the recruits enrolled at the last moment, sometimes one-third of the strength.

But there were other causes for delay in this mobilization. The necessary equipment, instead of being within the reach of the different organizations, was in federal arsenals, not very numerous and often at too great a distance from the units. Saddle and draught

animals were lacking for all arms. Great numbers had to be bought in all haste. The majority of the animals thus secured were not trained, and generally were put into the hands of men inexperienced in riding, driving wagons and adjustment of harness.

* * *

The press has been filled with recriminations concerning the transportation of the troops to the frontier, only a part of it was well founded. It is true that it was a mistake to concentrate too many troops in local camps, instead of having the organizations leave their locality of origin, as takes place in Europe. The trips to the concentration camp ought to have been avoided, as well as the congestion in the railroad stations of the camps. On the other hand, the great distances separating the points of departure and the frontier to be occupied must be taken into account. The east and northeast of the United States furnish the most militia troops and for whom it was a four or five days' railroad trip. Under such conditions, the adaptation of cattle cars for the transportation of men, as in Europe, cannot be considered. But a European would naturally be astonished at the noisy complaints of several guard regiments because they did not make the trip in tourist sleepers. These complaints were numerous enough to necessitate official explanations by the general staff.

It has been said on all sides that the men lacked rations en route. The truth is that, on account of the inexperience, the national guard, in a number of cases, consumed and wasted ten days' rations in three days. That is another one of the vices of our volunteer militia organization.

* * *

The service on the frontier naturally presents a certain analogy to that performed in Switzerland in 1870-71, and during the present war. However, in the United States, it offers a rare opportunity to give serious instruction to the militia troops assembled in Texas and Arizona. As much as possible, the grouping by states has been adhered to. The New York troops, for instance, constitute a complete division, under the command of their own generals. However, the lack of good field and general officers has made itself felt; an excellent measure has been the placing of regular officers, generally captains, at the head of militia regiments that lacked colonels.

The chief of staff has profited by this opportunity to train these troops. They have accomplished marches in which they needed instruction; these have been progressive, a precaution made necessary by the climate and the lack of training of the men.

The sanitary condition has been as satisfactory as possible, principally on account of the vaccination against typhoid. Lately, however, there have been a certain number of cases of para typhoid, which seems to us a new name for "light mucous fever." Still, in spite of a not very favorable season, nothing about the health of the troops recalls the horror of the Spanish-American war camps.

At the present time, in the private interest of the militiamen, they are trying to organize a sort of relief system; but it is necessarily very imperfect since very few troops were left in the various states.

—Pershing Expeditionary Force

See also

CARRIZAL, ACTION AT
OJOS AZULES, ACTION AT
ROADS, MILITARY (Article: "Road Work, in Mexico")

[With the Apache Scouts in Mexico. By Capt. J. E. Shannon, 11th Cavalry. *Jour. U. S. Cavalry Assn.*, Apr, '17. 7000 words. Illustrated.]

(An account of the services of twenty Apache scouts with the expeditionary force in Mexico. These scouts did not join until the pursuit of Villa was over. It is suggested that their services at an earlier time might have resulted in the capture of Villa. The appearance of the Apaches was far from the usual ideal of the Indian scout, but on suitable opportunity they showed that trailing was with them a science, and that once on a trail they were sure to follow it to the end. They are of little value in any set military formation, but as guides, hunters, and trailers they are marvelous, and with them as scouts surprise would be practically impossible.)

MEXICAN WAR (with U. S.)

[Our Preparation for the War of 1846-48. By Justin H. Smith. *The Militarian Historian and Economist,* Jan, '17. 6000 words.]

(An interesting paper dealing with our lack of preparedness for the Mexican war and the failure to profit by the lessons we ought to have learned even before that time. The method of appointing volunteer officers and of depending on Volunteer Armies, both of which proved disastrous, are discussed and valuable lessons drawn therefrom.)

MEXICO

[The Mexican Situation. Mexico—From the Inside. By Arthur Constantine. *The Military Historian and Economist,* Jan, '17. 3500 words.]

The author has spent two consecutive years in Mexico and six months subsequently along the border and has found but few people who see an end to the strife in Mexico unless the United States intervenes. Mexicans of all classes know what will happen if bandits continue to invade United States territory, yet they resent the presence in their own country of our punitive expeditions. All Mexicans resent what they call the meddlesome interference of the United States in their internal affairs, and place upon that government's shoulders the responsibility for all of their troubles of the past few years. They claim the ability to reconstruct their country if the diplomacy of the U. S. would leave them alone, and cite the Diaz régime as an example of the fact that before the interference of America in Mexican affairs there existed an element which knew how to govern the country, keep peace on the border, develop the resources of the country and observe foreign obligations.

MEXICO—Continued

Some of the contingencies in the Mexican situation during 1917 may be:

1. The downfall of the Carranza government.

Carranza is described as a huge, bulbous person, patriarchal in figure and aspect, silent, vague and brief of speech, heavy-witted, mentally and physically torpid, without charm or defined dignity, selfish, indifferent but inordinately ambitious. His army is composed of three or four rabbles which acknowledge loyalty first of all to their own generals. The ranks are made up wholly of Indians; the officers are mestizos or renegade whites. The Carranza scrip is now quoted at about two cents on the peso.

2. The defection of Obregon.

The support of Obregon is what, within Mexico, keeps Carranza in power, but Obregon is in every way Carranza's superior and in the end will follow the custom of his country which demands that the victorious general supplant his chief.

3. The "come back" of Villa.

This is hardly possible for already Villa is a done-for factor in Mexican affairs.

4. A counter revolution having for its object the return to power of substantially the elements that dominated in Mexico during the régime of Porfirio Diaz.

Such a revolution, if it ever become more than a dream or a hope, must be unopposed by the United States. Many of the foreigners in Mexico are convinced that the better native elements do not possess the requisite fighting blood, cohesion and patriotism to rout their oppressors, and if in the next year or so this conviction be confirmed, the list of contingencies in the Mexican situation ends with

5. Intervention by the United States.

—Army—Organization

[The Mexican Army. By A. Moreno. *The Military Historian and Economist,* Jan, '17. 2300 words.]

Under Diaz, Mexico had a good army, about the size of that of the United States, except that it had more field artillery in proportion and hardly any coast artillery. The officers, educated mostly at Chapultepec, were well educated and highly qualified. Under a long series of revolutions, this corps of officers has almost disappeared; some were killed by their own men, others joined the revolutionists and were killed in the battles that followed. Even under Huerta some of these officers still remained, but in July, 1914, when the Constitutionalists entered Mexico City even they had disappeared. No other case in history so well illustrates the fact that the officers *are* the Army.

What is now the Mexican Army began March 26, 1913, when 64 officers from the troops stationed in Coahuila met at the Hacienda Guadalupe and adopted the Plan of Guadalupe, whereby Carranza, Governor of the State, was named Chief of the Army. Its immediate head is General Alvaro Obregon, Minister of War and Marine. Hardly any of the lower officers are technically educated.

The War Department is poorly organized and has become nothing more than a series of administration bureaus, all of which neglect the questions of defense and the preparation of the army for war.

Under Diaz the army was organized and distributed into ten military zones, each commanded by a general officer; Huerta organized it into six mobile divisions, and now there is no fixed organization. The forces are divided into armies as follows:

Army of the Northeast, headquarters at Monterey.

Army of the Northwest, headquarters at Chihuahua.

Army of the East, headquarters at Cuernavaca, Morelos.

Army of the West, headquarters at Guadalajara; and

Army of the Southeast, headquarters at Merida, Yucatan.

Each army consists of from three to five divisions, designated numerically, and auxiliary troops. Each division consists of from three to five brigades, designated numerically or named for their respective commander. The organization of the brigades is not fixed. They have from 500 to 2000 men, and some have both mounted and foot troops. Only one division has any artillery, and that a regiment commanded by a major.

The only training the officers have had has been in the field. Recruits are given no special training, the reason being that many officers themselves know nothing. The field uniform and equipment cannot be described because there are none. The fine field guns of Diaz and Huerta have completely disappeared, but the supply of machine guns is ample and their use is excellent.

The troops can march fifteen or twentv miles, with few or no halts, and in the presence of the enemy can make thirty or forty miles a day. Nothing is known, however, of tactics and military art. The men are lacking in discipline, training and leadership. The surprise is often used, this frequently taking the form of a night attack.

In general, the soldier material is excellent, and with money and good instructors, Mexico could have an efficient military organization; but at present its army exists almost wholly on paper, lacks almost everything, and is struggling under great handicaps which are not likely to be bettered.

—History

See also

MEXICAN BORDER MOBILIZATION (1915-17)
MEXICAN WAR (WITH U. S.)

MILITARISM

[Militarism. By Lt. Quiroga. *Memorial de Caballería,* March, '17. 3000 words.]

The word militarism to many is synonymous with tyranny. Pacifists profess to believe that officers are despots who maltreat soldiers, who abolish their individuality and who convert them into mere instruments of dominion. Such persons depreciate military virtues and try to wrest from the armed institutions of the state their natural and legitimate prestige. In so doing they but labor against the state itself.

True militarism develops in citizens the noble spirit of self sacrifice upon the altar of patriotism. It inculcates the subordination of individual interests to the welfare of the nation. Militarism does not oppose manifestations of social life and liberty, but, without disturbing these, impels all other individual and collective energies to the progress and up building of the state.

Science, art, industry, commerce, agriculture and politics not only do not impede universal military service but themselves receive from it, regulation, order, discipline and above all adaptation of each of the individual energies to its maximum useful output.

Militarism would place each person in a post where his services could best be utilized to his own good as well as to that of the state. It would eliminate the misdirection of energy.

Militarism is preparation for war, and war is inseparable from, and necessary to, the existence of the human race.

MILITARY DECORATIONS AND REWARDS

See
DECORATIONS AND REWARDS, MILITARY

MILITARY EDUCATION

See
EDUCATION, MILITARY

MILITARY GEOGRAPHY

See
GEOGRAPHY, MILITARY

MILITARY GYMNASTICS

See
GYMNASTICS, MILITARY

MILITARY LAW

See
LAW, MILITARY

MILITARY ROADS

See
ROADS, MILITARY

MILITARY SURGERY

See
SURGERY, MILITARY

MILITARY TRAINING

—In Public Schools

The May-June, 1916, issues of *Kaikosha Kiji*, the chief Japanese journal of military science, had an extended study by a Lieut. Ichihei Kato comparing military training in the schools of Japan and the United States, respectively. This study goes into minute details.

MILITARY TRIBUNALS

See
COURTS-MARTIAL

"MINENWERFER"

See
FIELD ARTILLERY—MATERIEL—TRENCH MORTARS
GRENADES—USE OF IN EUROPEAN WAR (Article: "Types of Metal Grenades and Grenade Guns")

MINES

—In Coast Defense

[The Principles Involved in the Mine Defense of Harbors. By First Lieut. Carl A. Lohr, C.A.C. *Jour. U. S. Artill.*, May-June, '16. 6000 words. 1 fig.]

A submarine mine may be defined as a case containing a charge of explosive with a firing device, moored at or under the surface of the water for the purpose of disabling a hostile ship. A torpedo is a means for conveying an explosive charge thru the water to the under-water surface of a hostile ship and there exploding it. The mine defense of harbors, in its largest sense, takes in all means of attack against the underwater hull of hostile ships.

Ever since the Revolutionary War, the mine has been considered a possible weapon by the navies of the world. But not until the Russo-Japanese War was it much feared by belligerents. That such fear has been aroused is due to the greater efficiency of mines, and to the cost and time required to replace ships destroyed. To-day mines are used not alone in harbor defense, but in fleet tactics as well.

Many experiments must be made in connection with mine defense, since it is only by exact knowledge of many local conditions that a given project may be worked out.

Buoyancy is of greatest importance, especially in harbors where tidal currents are strong. For a 4-knot current in 80 feet of water and 10 feet desired submergence, a No. 32 case with 107 lbs. reserve buoyancy will be pulled down to 58 feet submergence, while a No. 50 case with 136 lbs. reserve buoyancy is pulled down to 27 feet.

Many advocate the use of the torpedo in mine defense because mines cannot be kept down in some of our harbors. But as torpedoes must be fired exactly as are guns, the torpedo stations are subject to being put out of action by gun fire from hostile ships as are the batteries. The mine cannot miss the ship that touches it while the probability of hitting with torpedoes is far less than with guns. Torpedoes are necessary for harbor defense, but no effort should be spared to keep our mines where we want them and to make them effective under the most adverse circumstances.

The weakest point of our present mine matériel is the means of attachment of cable and mooring rope to the mine. Other means should be experimented with and the best possible devised.

The difficulty of maintaining an exact submergence is lost sight of frequently. It cannot be done except by a device within the mine to regulate submergence with the tide. The exact amount of submergence to be given at mean low water is a local problem dependent upon the range of tide and strength of current. The reason for submergence is to hide the mines, and the

MINES IN COAST DEFENSE—Continued

main consideration in submergence is to ensure that it is less in amount than the draft of the ship intended to be attacked.

The relation of mines to each other should be considered carefully. The present practice of placing them in lines is good, but they must be laid in a systematic manner to admit of charting and so that we may fire a reasonable number and still keep our system in condition to resist attack. It is not necessary to destroy a ship to create confusion in the enemy's lines.

The mines should be so spaced in the lines that no ship can pass over the line without hitting one, and the lines should be far apart to cause a ship to foul but one mine at a time as it passes in, and to straighten out on its course before hitting the next line in rear. The distances are fixed by the beam of the ship, about 95 feet, and the tactical diameter, about 750 yards.

The location of the mine field in a harbor is a local problem. The ideal location is at the narrowest part of the channel, but here the current is most swift and the maintainence of the field as a consequence most difficult. Therefore to maintain the field we may have to move it out to a wider part of the channel.

As the mines become the last defense of a harbor, they should be made effective and the guns should be located with reference to them. Guns should be used to keep all enemy forces out beyond the mine field and thus ensure the mines against injury. Whatever armament is necessary for this purpose should be used regardless of caliber. The location of torpedo tubes bears much the same relation to the mines as does that of the guns. They should be located at the harbor entrance and in a protected cove so that the torpedoes may be properly launched and accurately started under easiest possible conditions. Torpedo boats and destroyers can render but little assistance to fortifications as they are easily seen and can be singled out and destroyed by the hostile fleet. On the other hand, submarines may be of the greatest assistance by being able to launch torpedoes at close range unseen by the enemy.

While every attempt should be made to secure accuracy of observation firing, the surest way of knowing when a mine is struck is to have it signal in that fact. Should the mine observation stations be intact, the mine commander may verify the mine struck and use his judgment as to whether or not to fire. This resolves itself into what may be known as delayed contact firing. Every precaution must be taken to protect stations and casemate, so that the mine system will be the last element of the defense put out by hostile attack.

Our navy and friendly shipping must be able to move freely in and out of mined harbors, therefore a passage free from mines must be left thru the mine field, to be closed upon the appearance of the hostile fleet, and while open with pilots to take thru all friendly shipping.

—Mine Planting and Mine Planters

[Planting and Raising Mines from Scow. By Capt. E. A. Greenough, C. A. C. *Jour. U. S. Artillery*, July-Aug, '16. 1250 words.]

As no mine planter was available for service in planting mines in 1913 by the 150th Co., C. A. C., an old scow, found abandoned on the beach at Fort Worden, was patched up for this purpose. This scow finally sank, and in the fall of 1914, a new scow was built for emergency mine work at Fort Ward.

This scow is 18 feet wide, 45 feet long, and 5 feet deep. It easily carries all the matériel for a seven-mine group, and ten can be put on it when planting a 19-mine group. Only seven mines were planted from it.

The multiple cable was laid from the scow expeditiously, the joints being made by the D. B. Boat. For planting, the scow was lashed securely first along the starboard side of a harbor boat. Mines 7, 8, 9, and 10 were planted from the starboard side of the scow, which then was changed to the port side of the harbor boat, and mines 11, 12, and 13 were planted.

In arranging the matériel on the scow for planting, the single conductor cables were coiled in a figure eight at the center; the mine cases were laid at the rear end, Nos. 7, 8, 9, and 10 on the starboard side and 11, 12, and 13 on the port; and the corresponding anchors were laid at the forward end. In planting, the single conductor cable was passed to the D. B. Boat by a heaving line in the usual manner, and at the proper time, the mine was thrown overboard by hand and the anchor after it by means of a lever. The planting detachment consisted of the chief planter and eight men. Some difficulty was found in raising mines due to lack of power devices for the purpose. The anchors were dragged along the bottom to shallow water where the mine cases would float. The mine cases then were hauled aboard the scow by hand, and the anchors were buoyed, to be raised later by a harbor boat equipped with hoisting gear.

—Use of in European War

[The *S. S. Noordam* and a Mine. By Captain A. H. Sunderland, C.A.C. *Jour. U. S. Artill.*, May-June, '16. 750 words. Illus.]

The *S. S. Noordam* of the Holland-American Line, while on a trip from New York to Rotterdam, struck a mine in the English Channel about noon, Oct 17, 1914, in Lat. 51° N., Long. 2° E. All the damage done was at the stern. Rudder supports were torn away, propeller shaft braces were cracked, and a plate, 2½ x 4 feet, on the port side, was stove in, flooding one small compartment. Wire rope was twisted up in both propellers. The ship was able to proceed to port under its own steam.

The ship was inspected in dry dock and the description of the damage is from personal inspection.

[Floating Mines. *Rivista di Artiglieria e Genio*, Jan, Feb, Mar, '17. 70 words.]

At the beginning of the operations against Verdun the Germans placed floating mines in the Meuse River.

It was planned that these floating mines should float down as far as, and explode against the bridges behind the French lines. The French, however, succeeded in removing the mines before any damage was done by them.

MINES, Land

See

SAPPING AND MINING

MINES, Naval

—Mine Planting and Mine Planters

[An Italian Mine Layer in Action. *Scientific American,* Apr 7, '17. 175 words. Illustrated.]

The illustration of an Italian mine layer at work shows the mines arranged in two rows on the deck of the vessel from which they are dropped at carefully charted points along the vessel's course. Each mine is arranged to sink to a predetermined depth where it remains in position awaiting contact with a vessel. The mine fields of Europe to-day extend in some instances for hundreds of miles. In no previous wars have mine fields approached the magnitude of those laid by Britain and Germany in the North Sea.

MOBILE FORCES

—Instruction and Training

[Preparedness. 1st Lieut. A. H. Mueller, 10th Cavy. *Jour. U. S. Cavy Assn.,* Apr, '16. 900 words.]

Adequate preparation for rapid entraining is believed to be wanting at many stations. To bring out the defects, it is suggested that there be solved, at any large station, the following problem: The command receives orders to proceed as rapidly as possible to X, two days' travel rations, ten days' field rations and ten days' forage to be taken.

Required: Time from receipt of order until cars are ordered, until entraining orders are issued and until cars arrive; the necessary orders and telegrams; number, each, of box cars, flat cars, baggage cars, stock cars, tourist cars, Pullman cars, and train sections; hour of departure of each section; organizations and attached personnel on each section; number and class of cars to compose each section.

MOBILITY

See also

MARCHES AND MARCHING—SPEED AND DISTANCE

MOBILIZATION

See also

PREPAREDNESS FOR WAR

[Measures for the Organization of Mobilization. By E. B. *Russky Invalid,* Jan 17, '17. 330 words.]

(This is an article stated by the author to be based on statements printed in the MILITARY DIGEST, number of magazine not given.)

Much interest has arisen in the United States in regard to methods of mobilization, due to the surprising success of the Germans in the early period of the present war. It appears that the mobilization of an army may properly be divided into two parts, the preparatory, and the mobilization proper. The former naturally ought to be undertaken during times of peace, and will include:

1. Preparations for supply of arms, munitions, etc.
2. Preparations for supply of equipage.
3. Preparations for supply of technical matériel of all kinds.
4. Administrative measures, such as registration, etc.
5. Sanitary measures.

These divisions may again be divided as follows:

1. Measures which can be accomplished immediately on mobilization.
2. Measures which can be accomplished within 15 days of mobilization.
3. Measures which will require several weeks for their accomplishment.
4. Measures which cannot be completed within a short time of mobilization.

The general staff of the United States army is giving much thought to this matter, with a view of presenting its conclusions to the Congress at an early date.

MONROE DOCTRINE

[The U. S. in World Affairs. The Proof of the Monroe Doctrine (Atlantic Side). By B. H. Richards. *The Military Historian and Economist,* Oct, '16. 2500 words.]

Some day the Monroe Doctrine will be put to the proof—war—but as yet it remains as innocent and naive as when first expounded by President Monroe.

It is a fact that we could not have supported this Doctrine in the past. What about its applicability at the present time? Considering the Caribbean Sea as an area particularly important to us, we find ourselves in possession of certain of the factors necessary to successful military operations in that zone. We have a powerful fleet and a line of bases. With Guantanamo as a center, a radius of 1200 miles will cover every point of the quadrilateral: Bermuda, the mouth of the Rio Grande, Panama and the mouth of the Orinoco. Since a fleet has a radius of action of 2000 miles, we are in a position to fight in the West Indies and along the South American coast as far as the eastern border of Venezuela.

Considering the applicability of the Monroe Doctrine beyond the Caribbean Sea, Brazil may be taken as the great potential military economic conquest of a European state. Such a conquest would be approached thru Pernambuco or Bahia as a naval base. Para, towards the West Indies, would be an important step in warding off American intervention, and Rio still more important. But Rio is unattainable by American naval action.

Unless we occupy Para as we do Panama we cannot expect to maintain the Monroe Doctrine in the Atlantic south of the Guianas. And the fleet itself, powerful as it is, cannot properly perform its function without the aid of three or four army corps. And we are quite lacking in this important element of defense.

In connection with these facts we must consider the following:

1. Are we tied to the Monroe Doctrine irrespective of all geographical and military factors?

MONROE DOCTRINE—Continued

2. After a consideration of those factors, are we prepared to limit our field of influence to the Guianas?

3. If we are not, are we ready to extend our military and economic enterprises into the valley of the Amazon, and to create an army that will give our Navy freedom of action?

4. Will our naval programs be co-ordinated to a rational view of the Navy's function in war?

MONS, Battle of

[The Retreat from Mons. By Col. T. H. Goodwin, R.A.M.C. *The Military Surgeon*, Aug, '17. 4200 words.]

(In this lecture, delivered before the Army Medical School, Col. Goodwin gives his personal experiences during the retreat from the Mons.)

The anxieties of the retreat would have been reduced by about 70 per cent had motor ambulance convoys been available, with motor ambulance wagons for all field artillery and cavalry field ambulances. A medical unit must at all hazards keep in touch with the formation with which it is serving. In the case of infantry this is not specially difficult, but with cavalry it was only by the most extreme efforts that the ambulance could keep up. This led to its subdivision into two sections, one light, always able to keep in touch with the cavalry, the other heavy, to follow later and to use the main roads.

MORALE

See also
DISCIPLINE
INFANTRY—INSTRUCTION AND TRAINING
WAR—MORAL FORCES IN

[Military Character. By Capt. Wm. S. Sims, U. S. Navy. *Proceedings Naval Institute*, Mar, '17. 17,000 words.]

I will refer but briefly to the essential qualities of the great leaders and touch upon principally the military character of the subordinate, his relation to his superior, the conduct of his superior toward him, and the duty of the superior in training him so as to inspire his loyalty, develop his initiative, and secure his cooperation. Masters of war have told us comparatively little of how we, the subordinates, are to inspire the maximum effort on the part of our subordinates, to the end that we in turn may render the maximum service to our superiors.

The whole secret seems to lie in the proper union of loyalty and initiative. Either, without the other, is dangerous. If these qualities exist in a civil sense it does not always follow that they will prove successful in a military sense; for the two must be so coupled as to promote efficient team work.

This idea may be illustrated by the former and present methods of military control. The old system of requiring unquestioning obedience to explicit orders from superior authority, broke down before that which combined loyalty with the use of trained and intelligent initiative.

Henderson in his "Science of War" gives us some very pertinent facts about the Prussian understanding along this line between 1866 and 1870. The Germans recognized three things: "First, that an army cannot be effectively controlled by direct orders from headquarters; second, that the man on the spot is the best judge of the situation; and third, that intelligent cooperation is of infinitely more value than mechanical obedience." They made a clear distinction between "orders," which were to be obeyed instantly and to the letter, and "instructions," which were an expression of the commander's wishes and were not to be carried out unless manifestly practicable. "Instructions" only were to be sent, save where an officer was present with the body of troops concerned and fully aware of the situation. They then trained officers to "arrive at correct decisions" so as to insure subordinates' actions being in accord with their superiors' wishes, and finally discouraged to the utmost the spirit of rash and selfish enterprise. Added to this, every officer was educated at the same school and taught to adapt his action to the same principles. From the moment he joined his regiment he was encouraged in his spirit of initiative, independent judgment, and self-reliance. Superiors were forbidden in the most stringent terms to encroach upon the prerogatives of their subordinates. To the initiative of the subordinate leader, who thruout the whole campaign did not allow a single favorable occasion to escape unutilized, did the Germans owe their uninterrupted triumph in the Franco-Prussian war.

I make this lengthy citation on account of the prevalent misconception that all operations of the German General Staff are ordered in the minutest detail. On the contrary that body lays more stress on tactical thinking.

The ability to reach a correct decision is not an inherited characteristic. It involves a logical consideration of all available information and experience. It requires a knowledge of technique and a spontaneity in which the civilian mind has had no training. Both initiative and decision flow from practice in logical thinking combined with knowledge and experience.

Only in isolated cases have military and naval leaders in the past trained their subordinates in the exercise of initiative. Nelson's fleet was a team trained to work together in perfect loyalty to the fleet and to its leader. This accomplishment was due to frequent conferences with subordinates. The completeness of his victory over the French at Aboukir was the result of dispositions due to the initiative of his captains. Too often has his example been disregarded. Bad manners, lack of sympathy and tact, ignorance of, or disregard of, the elementary principles of governing men, and mistaken ideas of punishment, have all detracted from the spirit of loyalty. It would appear, too, that there has been excessive severity in the exercise of authority, little or no attempt to control bad tempers, not much respect for higher authority, and excessive solicitude for personal dignity. Even yet there are those who conscientiously practice such precepts as the following:

"Never fail to punish all faults, including those of omission, if you want to have an efficient ship.

"Always put at least two officers under suspension to insure a general order being carried out properly.

"An executive officer should not be on speaking terms with any of the watch officers.

"Never consult a subordinate. Give him an order and insist that he carry it out in detail, as directed. He is not paid to think.

"Nothing brings a man to time so quickly as solitary confinement in the brig on bread and water."

Such undiscriminating severity invariably leads to trouble, and when combined with disrespectful or contemptuous treatment sometimes causes such complete disaffection and resentment as to result in very serious failures of discipline.

The pity of it is that so many men of great potential ability should not only have ruined their own careers, but have actually inflicted continuous injury upon the service, thru neglecting to make an estimate of the situation as regards their characters, and thru neglecting to use their brains to determine the qualities and line of conduct essential to success in handling men. Such a reasoned process applied to the most important attribute of an officer, his military character, would have saved many from partial or complete failure, thru the conviction that it was actually their duty to maintain an inflexible manner toward their subordinates, to avoid any display of sympathy, and to rule by the severity of maximum punishments. Such officers go thru their whole career guided by a snap judgment or a phrase borrowed from some older officer. Of good brain power, they neglect to subject themselves to logical analysis. Moreover, they are usually self-satisfied and frequently boastful of their unreasoned methods of discipline.

Above all things let us not regard loyalty as a personal matter. No faults on the part of superiors can excuse any failure in loyalty on our part. You feel that it is impossible to be loyal to such a person as described above. Your loyalty is not due to him alone, or to any other person, but to your organization, your ship, your "team."

Of course an affront to personal dignity should never be inflicted upon a subordinate; but do not imagine that submission involves any loss of personal pride or self-respect. Quite the contrary, for not only can you congratulate yourself on a victory in self-control, but on an impressive illustration of the evil influence of the abuse of authority, of injustice, of disrespect, or of bad manners.

War is a vitally important game of one team against another, and if your team is not adequately trained it will suffer defeat.

Let me, therefore, enumerate a few of the most important items to consider in promoting loyalty and initiative.

1.—Always let your general mission be understood. The American is willing to co-operate when his intelligence is enlisted.

2.—Invite suggestions and consider them carefully.

3.—Hold conferences for this purpose.

4.—Make use of competitions where practicable.

5.—Explain the necessity for constant drill. The thing is often misunderstood even by the older men.

6.—Be sure you know thoroly the subject of all your instructions. Knowledge of your job commands respect.

7.—Encourage your men to come to you for information on any subject, and take pains to look it up and supply it.

8.—Train your men in initiative by "putting it up to them" on proper occasions, and explain why you do it.

9.—When you have inspired loyalty in all of your men, more than, half your troubles will be over, for thereafter initiative will develop rapidly if you give it intelligent direction and adequate opportunity.

10.—Maintain discipline with the minimum reference to higher authority.

11.—Always be considerate of inexperience.

12.—Be absolutely just in your dealings with your men.

13.—Avoid harshness in manner and methods. Inflict punishment in sorrow, not in anger.

14.—Never destroy or decrease a man's self-respect by humiliating him before others.

15.—Do not let the state of your liver influence your attitude toward your men.

16.—Do not inflict severe reprimands for minor faults.

17.—Remember that the purpose of all punishment is correction. Never let the spirit of revenge enter in.

18.—Before you take any action, consider carefully its effect upon the man's loyalty, his development of character, and the discipline of the organization, whether a company, division, or a ship.

19.—Remember that every one of your official acts exerts a certain influence one way or another.

20.—Avoid as you would the plague, hostile criticism of authority, or even facetious or thoughtless criticism with no hostile intent.

MOROCCO

[Africa. New Organization. *Memorial de Caballería,* Nov, '16. 1700 words.]

(A continuation of the general order of the Commanding General of the Spanish forces in Morocco referring to the reorganization and distribution of the troops now garrisoning that territory.)

[Physiognomy of Hostilities in the Rif and in Yebala. By Gen. Berenguer. *Mem. de Caballería,* Feb, '17. 4300 words.]

(Taken from a work in preparation. An interesting account of the customs and fighting methods of the Kabyles of Northern Morocco.)

The extreme mobility of individual warriors, inability to deliver collective fire and the impossibility of control by one commander combine to reduce offensive action of the Kabyles to two typical forms only: first, to entice small groups of soldiers, such as troops on security duty, out of reach of support and upon favorable ground, then to fall upon them with overwhelming numbers in an enveloping attack; second, against

MOROCCO—Continued

columns organized for combat, or in march against their strong places, to make a frontal attack followed by a movement against one or both flanks. Apart from these forms their offensive capacity is manifested by ambuscades, surprises, etc., the idea being generally to capture booty and escape. Ambuscades are sometimes used in combination with other forces which attract the attention while those who have struck the blow disappear. The decoys are frequently but a horde of poorly armed camp followers. The density and slow pace of troop columns favor a method often used of annoying columns by firing into them from a distance without object other than to cause losses. This practice is responsible for a great many casualties in Moroccan campaigns.

[Africa. Strategic and Commercial Itineraries in the Zone of the Protectorate. By A. de S. *Memorial de Caballería,* Mar, '17. 1500 words. 1 sketch.]

(Continuation of a description of the military geography of the territory of Tetuan and of Melilla).

Tranquillity now reigns in the occupied region but along the borders there is some local agitation caused by nomadic tribes of the interior. The markets established are frequented as usual by Moors and Kabyles from the neighboring territory and trade progresses normally.

MORTARS

See also

ARTILLERY—FIRE—HIGH ANGLE
COAST ARTILLERY
FIELD ARTILLERY—MATERIEL—TRENCH MORTARS
GRENADES—USE OF IN EUROPEAN WAR (Article: "Types of Metal Grenades and Grenade Guns")

MOTOR BOATS

See also

SUBMARINES—DEFENSE AGAINST—MOTOR BOAT SUBMARINE DESTROYERS
SUBMARINE DESTROYERS

MOTOR TRANSPORT

See also

AERONAUTICS—TRANSPORT—BY MOTOR
FIELD ARTILLERY—MOTOR TRANSPORT
HORSES
INFANTRY—MOTOR TRANSPORT OF
KITCHENS, MILITARY—FIELD—KITCHEN WAGONS
MACHINE GUNS—MOTOR TRANSPORT OF
SANITARY SERVICE—TRANSPORTATION OF SICK AND WOUNDED—MOTOR AMBULANCES

[Truck Cost System for Army. How "Ton Mile" Serves as Performance Comparison in Practice. By George Neill of the Packard Motor Car Co. *The Commercial Vehicle,* Nov 15, '16. 1000 words.]

(The *Commercial Vehicle* answers a question of First Lieut. Leigh S. J. Zerbee on "truck" economy and makes reference to an article "What the ton-mile is, and how to figure it," appearing in the Apr 15, '16, issue of this magazine. It also refers to Mr. George Neill of the Packard Motor Car Co., who has made "a specialty of analyzing the cost of operation of motor trucks.")

[S. A. E. Finds War Truck Standardization a Difficult Undertaking. By a Committee of the Society of Automobile Engineers. *The Commercial Vehicle,* Nov 1, '16. 10,000 words.]

(A set of proposed standard specifications for the U. S. Army trucks is discussed in detail. A complete directory of motor truck makers showing 211 manufacturers of 1917 auto-commercial vehicles, is also given.)

[Four-ton Canadian War Service Truck. *The Commercial Vehicle,* Dec, '16. 4000 words. Photographs.]

(A detailed account of the specifications and development of the four-ton truck as demanded by the military establishment of Canada.)

Russia

[Petrograd-Archangel Automobile Line. *Scientific American,* Feb 3, '17. 80 words.]

An important motor truck service has been organized between Petrograd and Archangel, a distance of 1200 miles. At present over a month is required for the trip. About twenty trucks will start each day from the two ends of the line.

United States

[Trip of Motor Truck Co. No. 4 *Army & Navy Jour.,* Dec 2, '16. 750 words.]

(Official report of a trip from Fort Sam Houston, Tex., to Fort Sill, Okla; total distance 508 miles.)

Roads excellent to fair, with one stretch of mud. Norther encountered one day with temperature 4° above zero, Fahr. Some difficulty in keeping radiators from freezing before starting.

Breakage disabled one truck, which was then towed. Only motor trouble with fan belts and push rods. Dixie magneto good in cold weather.

Packard special trucks are far superior to standard, being geared lower and better equipped, and built heavier and stronger. Firestone tires stood the test of all road conditions.

Motor Truck Co. No. 4 consisted of 27 one and one-half ton special Packard trucks, 5 one and one-half ton standard Packard trucks, and one Reo touring car; personnel, one officer, 20 enlisted men, and 20 civilians.

Gasoline used on trip, 3381 gallons; oil, 150 gallons; grease, 50 pounds. Average 5.0 miles per gallon of gasoline.

[Army Motor Transportation. *Army & Navy Jour.,* Jan 27, '17. 750 words.]

During the past year, 1318 1½-ton trucks and 1064 3-ton trucks have been procured for use of the army in Mexico and on the Mexican border. The experience with these trucks of various makes has been of the greatest value to the government and the manufacturers in determining the weak and the good features of construction. Some of the weaknesses found are: gear ratio too high, insufficient ground clearance, in-

sufficient traction, too rigid construction, not enough cooling capacity, unsatisfactory springs. Low gear ratio and extremely flexible construction were found best suitable for pulling thru heavy mud or sand.

[Motor Transport and the New Army. *Army & Navy Jour.*, Apr 14, '17. 550 words.]

An American army of a million men will need about 40,000 motor trucks, evenly divided between the 1½-ton and 3-ton types. The 3-ton truck companies will be used for hauling from rail-heads over good roads; the 1½-ton trucks will haul over the inferior roads from the points where the larger trucks leave off to the field trains of the various units.

[Motor Transport for the New Armies. *Army & Navy Jour.*, July 21, '17. 500 words.]

Contracts have been placed by the Q. M. Corps for the delivery by Jan 1, 1918, of 10,650 high powered motor trucks, about evenly divided between 3 and 1½-ton types at a cost of over $33,000,000. A total of 70,000 trucks will be required for the new forces. High powered chassis for use in armored cars will also be provided. Contracts for 5000 motor cycles were awarded to two firms. Many more will doubtless be required.

[15,000 Standard Army Trucks to Be Ordered for Delivery Between January and June, 1918. *Commercial Vehicle*, Oct 1, '17. 2600 words.]

The wheelbase is 160 in., the engine 4¾ by 6 in., cylinders cast in pairs with detachable heads, the transmission a four-speed, amidships, the clutch a dry disk inclosed in the bell housing, and the rear axle a worm drive, full floating type. Steering is by worm and worm wheel. Fuel feed is by gravity from a 15-gal. tank on the dashboard, there being a 16-gal. reserve tank under the seat, and ignition is double, with battery and magneto systems entirely separate. The frame is pressed steel, of channel section, and quite straight; the springs are almost perfectly flat, and Hotchkiss drive is used. Both brakes are internal and on rear axle. Force feed lubrication is used thruout and the oil is doubly strained. The crank case, including the bell housing and the oil pan, is aluminum. Three-point support is used. The crankshaft is very rugged, and is notable for its large intermediate bearing, as long as the rear one. The governor is the steel-ball type, and so inclosed and sealed that it cannot be tampered with.

Taken as a whole, there is nothing peculiar in the design except its unusual strength for the load capacity. It is really a 5-ton truck, and will probably weigh about 8500 lbs. for the chassis with wheels and tires but without any body parts.

[The Army's New Motor Truck. *Army & Navy Jour.*, Oct 20, '17. 900 words.]

The War Department is highly pleased with the "War Truck," designed by two score of engineers and hundreds of draftsmen, and manufactured in parts by a number of manufacturing companies. The first completed truck was assembled at Lima, Ohio, on Oct 7, three days ahead of schedule. The designing and assembling of this truck sets a new time record in American production. The truck is one of the greatest engineering successes of the war and is destined to revolutionize army truck work so far as operation and maintenance are concerned.

Early tests of the engine showed fifty-eight horsepower at 1350 r.p.m., and the engine torque curve is better than anticipated. The total weight is 10,100 lbs. The truck is designed for a three-ton load, but it has a capacity for five tons.

Orders for 10,000 parts for the truck have already been placed with a good many different companies.

[The New War Truck. *Scientific American*, Oct 27, '17. 1700 words.]

The following is an illustration of one advantage of the new standardized war truck. It has 7500 parts. If the army possessed one million of these trucks there would still be only 7500 different kinds of parts to carry for repairs and replacements. On the other hand, 2,000,000 different kinds of parts are required to maintain all forms of motor transportation on the Allied fronts. One maker in England makes 17 different varieties of trucks, all of which are used by the English.

[Heavy Duty War Trucks. *Army & Navy Jour.*, Oct 27, '17. 360 words.]

All contracts for the new heavy-duty war trucks will have been placed by Nov 1, according to present plans of the Quartermaster Corps. It is expected that regular delivery of trucks will begin in January and that 10,000 Class B trucks will be completed by the latter part of next June.

[Two Sizes of Standardized Signal Corps Trucks Now Undergoing Strenuous Tests. *The Commercial Vehicle*, Nov, '17. 900 words. Illustrated.]

Due to the different work which the Signal Corps trucks will be called upon to do, they vary in quite a few details from the Quartermaster Corps Class A and Class B vehicles. The Signal Corps trucks are standardized, but, unlike the Class A and Class B vehicles, employ units which were already designed and which had seen several years' actual service in ordinary commercial vehicles.

The Signal Corps trucks are divided into two classes, a light truck for loads of 1½ tons and a 3-ton model. Approximately two trucks of the light type will be ordered to each one of the heavy. Both trucks will be assembled jobs made from standard parts.

Since the light truck is mounted on pneumatic tires both front and rear, it can be run at high speeds, the governor being disconnected for this work. The light trucks will draw a two-wheeled trailer with a body of light construction, 20 ft. in length. This is large enough to contain the major part of the average airplane.

Each truck squadron will have twenty-seven vehi-

MOTOR TRANSPORT—Continued

cles, at least two-thirds of which will be of the light model. One of the large units will be used as a traveling repair shop.

The light truck is fitted with Goodyear straight-sided, cord-construction casing tires, with all weather treads front and rear. Each truck is fitted with a special air pump driven off the truck gearset. This truck has a unit power plant with a four-speed gearset and a final worm-drive, employing radius rods to take the driving propulsion. The Continental engine is lubricated on the combination forced-feed and constant-level splash system. It has a Marvel carburetor; an Eisemann high-tension magneto; a tubular radiator with the water circulated by means of a centrifugal pump; a Monarch suction governor; a multiple-disc clutch; a solid propeller shaft in two parts, with three universals and supported in the center on a self-aligning ball bearing, and a worm driven axle.

The large truck is similarly constructed and has a normal load capacity of 6000 pounds exclusive of the body.

[Technical Details of the Liberty Truck. *Scientific American,* Nov 3, '17. 1336 words. Illustrated.]

The New Military Truck, popularly the Liberty Truck, while exceptionally strong and powerful, is of conventional design. It embodies all the modern ideas tried and proved in service, which means that no detail is experimental. The wheelbase is 160 inches. The engine has four cylinders 4¾ by 6, with 424 cubic inches piston displacement. Transmission is a four-speed, amidships clutch, dry disk inclosed; and the rear axle is a worm drive, full floating type. Steering is by worm wheel, fuel feed by gravity from a 15-gallon tank on the dashboard, with 16-gallon reserve tank under the seat. Double ignition with battery and magneto system entirely separate makes for reliability.

A straight frame of pressed steel channel section rests on almost perfectly flat springs. Brakes are integral and on the rear axle. The design has unusual strength for its load capacity. Really a five-ton truck, it weighs 8000 pounds without body.

It is hard to conceive of a better designed engine. Three points had first attention; first, the best possible lubrication, second, a water jacket reaching every hot point, and third, rigidity without excessive weight. An entirely enclosed governor of great simplicity cannot be tampered with when once set. Cylinders are cast in pairs with detachable heads. Spark plug pairs are located side by side, with a water space between bosses, in the center of cylinder.

As an example of careful detail, the water outlet pipe is offset to allow easy access to both plugs with a socket wrench. All the combustion space is in the head castings, the tops of the blocks being faced flat. Valve ports, 2⅛ in the clear, are tungsten steel head and stem, with 60-pound springs. Intake valves are restricted to 1 11/16 inches at the flanges, to maintain a fairly high velocity up to the moment of entering the cylinder. Cylinder heads are secured by 13 studs ½ inch in diameter, and each block is attached to the crank case with seven ¾-inch studs, the base flange being ½ inch thick at its thinnest and one inch thick at each holding-down stud-boss.

Crank case is all aluminum including the bell housing and pan. At the rear two deep arms act as rear supports. The diameter of case and flywheel housing makes these arms extremely short and they are so formed that the top of the bell makes a complete arch construction. The front support held in a swivel collar on a dropped cross member of the frame gives a three-point support with sufficient flexibility to counteract all stresses.

Complete pressure lubrication is used. Even the wrist pins are fed by tubes secured to the connecting rods. The pump and well are separated from the rest of the system by a wall which prevents falling oil from enterting without passing thru an elaborate screening system. Forward the pan is shallow, giving great clearance over the front axle, sloping to the deep rear end which contains the oil. A deep settling chamber catches all particles of carbon and impurities, preventing them from passing into the main oil reservoir. In addition, a large screen of wire mesh and still another on the pump intake makes oil circulation go from pump to bearings to settling chamber to first screen to second screen, and then around again. Draining the settling chamber does not affect the main body of the oil, so very little need be wasted.

Valve tappets are housed individually in the crankcase. Timing is as follows: Exhaust opens 45 degrees early, closes five degrees late, intake opens 12 degrees late, closes 25 degrees late. A skew gear on the rear end of the shaft drives the oil pump shaft. The pump shaft is vertical and coupled to the pump by a short coil spring. Both drive shaft and pump shaft are slotted and the two ends nearly meet the bent over extremity of the springs setting in the slots, allowing the oil pan and the pump to be removed and replaced with a minimum of trouble.

On the right side of the engine are the generator, the carburetor and both manifolds. On the left are the water pump, magneto and battery ignition distributor, the latter set on top of the front end case, driven by skew gear off the water pump drive shaft. This makes for ease in linking together the magneto and the timer advance controls, and keeps all wiring on the one side of the engine.

The governor consists of steel balls held between a disk sliding forward against a spring and a female cone fixed to the camshaft. The disk bears upon the short end of a vertical lever, the upper end of which is linked to a throttle in the intake manifold. This lever is fully inclosed and the spring which pushes against the centrifugal action of the balls is set in the case half-way up the lever.

Pressure on the spring is set by a threaded plunger with a lock nut secured by a sealed wire, entirely preventing unauthorized adjustment.

Water pump is a separate assembly, its shaft coupled to the drive shaft. It is detachable without disturbing the front end. The magneto, back on the left side, is coupled to the pump shaft. Clearances are large, and

no accessory is placed awkwardly. The crankshaft is 2½ inches in diameter on the three main bearings and 2⅜ on the pin.

The flywheel is 20 inches diameter and four inches wide on the rim, the weight being 130 pounds. The cast iron pistons are 6⅛ inches long with three rings and a 1⅜ hollow wrist pin locked in position. Ten thousandths clearance at the top and over the upper ring is called for, and four thousandths on the lower ring and the rest of the skirt. The manifolding system, designed for heavy gasoline, is the most experimental thing about the engine.

The carburetor is set high and will be a vertical model, tho the make ultimately decided upon will be settled by trial. The multiple dry-disk clutch of 18 plates is completely enclosed in a bell housing, and detachable from the flywheel in practically the same way as a unit power plant. The aluminum casting embodies a platform to which gear lever and hand brake control unit is bolted. The clutch has a reasonably heavy pedal action and the throw-out bearing is unusually large to give great durability. Between clutch and transmission is a short universal shaft.

The transmission gives four speeds, with direct on high; the lowest gear ratio (allowing for the 9½ axle reduction) is 56 to 1. Provision is made for attaching a winding gear to the side of the transmission if required. The case is aluminum, and clutch and transmission together weigh about 300 pounds.

The transmission is so ingeniously hung that to remove it, it is only necessary to remove a cap, knock out two pins at the rear, after disconnecting the pins in the three-gear shifter rods, and disconnect a universal joint.

The propeller is normally horizontal, in a practically perfect position for the drive. The axle, tho it contains much that is ultra-modern, is in exterior appearance of standard construction. It is a full floating pattern with a pressed steel case and has taper roller bearings all thru, even to the worm shaft. Both sets of brakes are expanding, side by side on the same drums, of the band type and provided with adjustment for setting concentrically. In laying out the brake connections, great care has to be taken to plot the path of the brake lever eyes as the spring deflects. The two cross shafts are placed so that the axle movement will have a minimum of effect upon the brakes to compensate for torsional deformation of the spring. The axle brake levers are carried up till the eyes are nearly in line with the top plate of the spring. Thus spring deformation causes an up-and-down movement of the levers instead of a horizontal one, and the vertical movement does not affect the tension of the brakes rods.

—For Soldiers on Leave

[The Night Motor Transport Column at Work in London. *Sphere,* Dec 9, '16. 800 words. Illustrated.]

The Y. M. C. A. in London has organized a Night Motor Transport Column to meet and transport soldiers arriving from the front. The service is free. Private owners driving their own cars give their services to the Y. M. C. A., supplementing those owned by that organization. The work is done from 10 p. m. to 8 a. m. Petrol is provided by headquarters. The cars are usually driven by men over military age, and in some cases by ladies.

—Fuel for

[Gasoline from a New Source. *Scientific American,* Mar 24, '17. 120 words.]

The United States Geological Survey estimates that from the distillation of hydrocarbon shales in Colorado alone more than 20,000,000,000 barrels of crude oil can be obtained, from which 2,000,000,000 barrels of gasoline can be extracted by ordinary methods. This shale is also deposited in northeastern Utah.

—Of Troops

[Cavalry and Auto Trucks. By Brig.-Gen. James Parker, U. S. Army. *Jour. U. S. Cav. Assn.,* Jan, '17. 3700 words.]

(In this article the author discusses a combat exercise, the object of which was to determine how and to what extent infantry mounted on auto trucks can be used as an independent force in hostile country. The exercise was so drawn as to bring about the pursuit of a rear guard consisting of cavalry by an infantry force in auto trucks. After describing and discussing the exercise, the author concludes as follows:)

Infantry in friendly country can travel 100 miles a day in auto trucks. If opposed by troops in hostile country it must travel slowly. Motorcycles can seldom replace cavalry in scouting and advance guard work, because they cannot leave the road or scout off the road on foot without great delay.

Speed does not protect a truck train. Presence of hostile troops requires outguards to prevent delays by obstacles placed in the road, destruction of bridges, etc. This is true even if machine guns are carried.

Infantry in auto trucks cannot act independently. It requires an escort of cavalry. Motorcycles replace cavalry only to a small extent. Furthermore, assuming unimpeded arrival at destination, cavalry will then be needed.

How can cavalry accompany motor trucks? It is believed that 200 miles can be covered in four days by having each horse ridden half the time and led the balance of each 50-mile daily march, each trooper riding and leading two horses 25 miles and then riding the other 25 miles in the trucks. Extra forage would be required for horses undergoing such marches. The order of march would be: cavalry advance guard, cavalry led horses, cavalry (men) in auto trucks, infantry in auto trucks.

The use of auto trucks will be of great assistance to cavalry for long marches or raids, insuring transportation that can conform to the maximum rate of march that might be used, which wagon transportation cannot do. Auto trucks and motorcycles do not replace cavalry, but they greatly increase the efficiency and use of cavalry.

—Repairs and Renewals

[Auto Truck Repair Shops. *Army & Navy Jour.,* Mar 24, '17. 700 words.]

MOTOR TRANSPORT—Continued

The largest and most modern motor transport shops of the United States Army are located at Camp Wilson, San Antonio, Texas, where everything from the light motorcycle to the heavy tractors in the southern department east of El Paso undergo repair. The shops are built of steel, iron and glass in such manner that they can be dismantled very quickly. The plant employs 150 skilled mechanics. It is equipped with the newest machinery and amply supplied with spare parts, bought direct from the factory, thereby reducing the cost of repairs to a minimum. Seventy-two vehicles can be repaired each day.

—Use of after European War

[Utilization of Army Trucks After the War. *Scientific American,* Jan 20, '17. 500 words.]

A committee, appointed by the French Minister of Agriculture to study the utilization of army trucks after the war, has advanced the idea that motors from trucks no longer operative, due to chassis defects, could be sold to farmers for generating power for agricultural purposes. Also, that trucks of sufficient power could be transformed at a cost of about $250 into tractors for agricultural use, such as hauling and plowing.

—Use of in European War

[The Automobile in War. Anonymous. *Schweiz, Zeit. f. Art. u. Genie,* Feb, '16. 4000 words.]

(A reprint of the original article appearing in *Mitteilungen über Gegenstände des Artillerie u. Geniewesens.*)

The present great war may truly be called a technical war. It is estimated that over 200,000 motor vehicles of all kinds are now doing military service. Of these 60,000 are German, 70,000 French and 20,000 English. About 25% are trucks, tractors and busses, and the remainder requisitioned touring cars. It is estimated that these automobiles will require about 12,000 wagons of benzine to run them for the year, and if we add to this the cost of new tires, spare parts and repairs, depreciation, etc., the military automobile represents a value of a billion dollars. This estimate is confirmed by the exports in automobiles and supplies from the U. S.

The automobile has established itself as the most efficient, economic and satisfactory means of transportation in the field. It lends itself to manifold uses. The advance of the Germans on Liège and the movement of 700,000 French troops in 6000 automobiles from Versailles to Meaux in September, 1914, are impressive examples of their use to move troops rapidly. As ambulances they have the advantage of being able to go forward, very close to the firing to receive their charges. The transportation of supplies and munitions is accomplished by tractors and trucks almost entirely. Then there are many special types armed with anti-aircraft guns, machine guns, etc., and others equipped with wireless, search-lights, field kitchens, water tanks, laundries, forges and repair shops, hospitals, Roentgen-wagons for surgical purposes. If adapted to any special purpose, all of these wagons generate the power for this work. For transport of heavy artillery and for towing heavy loads and trains, the caterpillar tractors have rendered the best service. The four-wheel drive tractor is also used for this purpose, especially for the rapid transport of heavy artillery.

The system of subsidizing automobiles in time of peace was in force in Germany and Austria, and accounts in a way for their rapid mobilization. By offering subsidies, the government has the means of insuring uniform type. This is a great advantage in time of war, because it produces simplification in spare parts and repairs, and uniformity in the training of the chauffeur.

In its general construction it may be said that the modern automobile has efficiently met the requirements of war. Certain small changes have been suggested as follows: frequent use on soft roads made a greater clearance desirable; more protection for the radiator from damage due to collision; enlargement of the gas reservoir; more comfort for the driver; sufficient space for space parts.

[European Methods of Handling Military Machines. By Major J. M. Phillips. *The Power Wagon,* May, '17. 4000 words. Illustrated.]

Germany was best prepared of the European nations in motor truck transportation at the outbreak of the war. Everything was ready and complete, but the system was inelastic and ultimately broke down. The basis—the 5-ton truck and trailers—was all right for good roads, but the roads were broken down by heavy use and the 5-ton truck is helpless off the road in soft ground. The conditions near the front prevent the operation of heavy trucks nearer than 10 to 12 miles from the front line. Lighter trucks can cut this interval to from 4 to 8 miles—a great advantage where the extra haul must be by wagon.

The Germans modified their system and now have many 1½ and 3-ton trucks, but they are badly off for tires and are forced to use poor substitutes for rubber.

The British motor truck organization is good, and its methods are essentially American by reason of the heavy sprinkling of American drivers who have found their way into the service.

The French system is the most perfect, and is very flexible. The trains are varied to suit the requirements and are dispatched by a dispatcher in charge of the district. Distances and speed are prescribed and enforced.

The Russian system of motor truck transportation is very inefficient, due to the initial lack of trucks and consequently of experienced drivers, and to the fact that the Russian peasant is not quickly adaptable to strange mechanisms. To the irregularities resulting in the motor truck service may be traced many of the variations in effectiveness of Russian military operations. If the transportation service worked well the operations went well; but if it broke down the resulting deficiency in supplies was reflected in the breakdown of the operations.

[Motor Traction in Modern War. *Scientific American,* May 19, '17. 1000 words.]

The heroic defense of Verdun will go down in his-

tory as a victory for the French, made possible only by motor transport. With the railroads leading to Verdun destroyed and always under heavy gunfire which prevented their reconstruction, the Germans believed that but a brief investment would be required before the French would be forced to retreat thru failure of ammunition and supplies. Thousands of motor trucks, a large proportion of which were of American manufacture, were rushed by the French to the threatened sector. An unfailing stream of supplies, ammunition, and reinforcements was maintained despite the severest possible shell fire.

The United States is fortunate in having more motor vehicles in use in its territory than has all the remainder of the world. Supposedly reliable statistics show that there are 3,500,000 motor cars of all types in use in our country.

[Lessons of the War in Truck Design (continued.) By W. Owen Thomas. *The Commercial Vehicle,* July, '17. 2600 words.]

The trucks used in France by the British at the beginning of the war were mostly commercial vehicles. There were nineteen different makes and forty-two different models, so that the problem of maintenance was very great.

The main points of design were satisfactory but troubles occurred with the gear ratios and other minor details. Many trucks were too low geared on high to stand high engine speeds and all were too high geared on low and reverse to stand bad roads.

Truck transportation in the English Army is handled by the Army Service Corps which has charge of the feeding of the army. In the French Army before the war, the truck service was part of the artillery command. In both armies it has been necessary to call in motor truck experts.

The training of the personnel is important. Replacements of men amount to 3 per cent a month. Besides these, two months reinforcements must be available at the advanced base and also two months reinforcements at the main base.

Thoro training of truck drivers or convoy officers requires three months. The training is divided as follows:

1. Text-book work.
2. Driving and operation.
3. Maintenance and repair.

American trucks are more poorly designed than European ones in detail refinements but are better in part interchangeability.

Three per cent of the main units in service and up to 100 per cent spark plugs are the spare parts required monthly by the British to maintain their trucks in service. A stock of parts equal to a six months' supply is kept at the various bases. About 2 per cent a month of the complete trucks are replaced by new ones. The average life of a truck is eight months and the truck investment averages $16 a day for each truck in service.

Parts must be standardized. Operating mechanisms such as clutch fittings and gear-shifting devices should be integral with and supported by the parts they control. Tire treads must be standardized. Protection of all parts against mud and weather is of prime importance. Good road clearance and sharp turning radius are necessary. The English use principally one size of truck of 3-ton capacity. The French use trucks of 2 and 5 tons.

Trucks are normally operated at from 12 to 15 m.p.h., but most of them in France are geared to operate at 18 to 20 m.p.h on high gear in emergency. They are required to operate on second gear up to a speed of 12 m.p.h. to prevent slowing up on hills. The later trucks have a reduction of 50 to 1 on low gear for ease of maneuver without racing the engine in starting on bad roads.

[Lessons of the Great War in Motor Truck Design. By W. Owen Thomas. *Commercial Vehicle,* July 15, '17. 1500 words. (To be continued.)]

(The article is self-summarized in its main points as follows:)

1—Engines must be able to run continuously at a speed proportional to a truck speed of 20 m.p.h. on high gear, to take care of emergency conditions.
2—Fixed piston pins give much trouble.
3—Floating pins and bearings best for field service.
4—Clutch should be separate from the engine unit because of the excessive strain of overhanging weight on rear engine bearings.
5—Pressure lubrication of crankshaft, crankpin and camshaft is essential.
6—Oil-pressure gages are unreliable.
7—American carbureters are poor.
8—Ignition systems need refinements.
9—Ordinary type of muffler useless under service conditions because of flimsiness.
10—Gasoline tanks under the seat should be removable from the end; two tanks are better than one large one with reserve capacity.
11—Gasoline pipe lines should be woven on the outside with some material to prevent crystallization.
12—Radiator fan should not be belt driven.

[Lessons of the Great War in Motor Truck Design. By W. Owen Thomas. *Commercial Vehicle,* Aug 1, '17. 2300 words.]

(The article is self-summarized as follows):

1—Straight-sided pressed-steel frames most desirable for army trucks.
2—Rear brackets of the front springs must be short to avoid trouble.
3—Open towing hooks give trouble; hooks should be closed.
4—Steering gear should be so designed and mounted as to permit of entire unit being taken off with disassembly.
5—Low bodies necessary for easy loading and unloading.
6—Body tail-gates need improvement in design.
7—Trap doors in body floor of no value, as gearsets

MOTOR TRANSPORT—Continued

8—Separate engine, and clutch and gearset units are ideal for quick replacements.
9—Woven-disk universals will supersede the lubricated metallic type.
10—Differentialless war trucks give best service.
11—Reversed Elliott-type front axles better than ordinary kind.

[Lessons of the Great War in Motor Truck Design. By W. Owen Thomas. *Commercial Vehicle*, Aug 15, '17. 2400 words.]

(The principal points are self-summarized as follows:

1. Improper brake release cause of much trouble.
2. Brake protection against mud is a prime requisite.
3. Demountable tires often had to be taken off the wheels with sledge hammers because of rusting. Pressed-on type is now standard on all British war trucks.
4. Single rear tires better than duals.
5. Metal wheels rapidly replacing wooden type.
6. All forms of inclosed drive superseding chain type.
7. The average truck jack is useless in war service.

[First Details of the Miraculous Truck Work Performed in Saving Verdun. By W. F. Bradley. *Commercial Vehicle*, Aug 1, '17. 3500 words. Sketch, map and illustrations.]

(Editorial note. This article is by the special representative of *The Commercial Vehicle* with the allied armies, and is the first accurate and detailed account of the work of the motor trucks in saving Verdun. The article has been approved by the head of the Truck Service of the French Army.)

Motor trucks saved Verdun. When the Crown Prince began his attack in February, 1916, the ground held by the Germans at St. Mihiel denied to the French the use of the railroads. Bar-le-Duc, 34 miles south of Verdun, was the most advanced point on the railroad that could be used for the supply of the troops holding Verdun.

The region in rear of Verdun is poorly supplied with roads, and actually there was but one good road from Bar-le-Duc to Verdun over which to transport all ammunition and supplies, evacuate the wounded, and perform all the immense transport service involved in the defense of Verdun. Even this road was classed as a "Chemin de Grande Communication," or third class road, not wide enough for three vehicles abreast.

This road was closed to all but motor truck traffic. "The lack of an alternative route made it impossible to establish one-way traffic. The road was divided into six sections, each one in charge of a traffic officer, assisted by an adjutant, having at their disposal three passenger cars, two light cars, three motorcycles, together with their drivers, and also nine non-commissioned officers and experienced drivers, and a number of gendarmes, or military police."

All truck traffic had to travel in sections of five vehicles, the last carrying a big red disk showing above the body. The interval in sections was 10 to 15 yards, but it was forbidden to approach nearer than 50 yards to a red disk. Vehicles were held up only between sections.

No obstruction of traffic was tolerated. If a vehicle stopped, it had to get off the road immediately. This rule varied somewhat in its application. In rush hours it was enforced rigidly. Sometimes the state of traffic would permit repairs taking only a few minutes, but if conditions demanded it, vehicles were run off into the ditch at once, even if overturned as a result. Breakdown gangs looked after these cars. If a truck had to be towed back for repairs, it had to proceed over other roads. At times when traffic permitted it, the road would be closed for two or three hours and the breakdown gangs would go out with necessary tackle and bring in the wrecks.

With truck sections, no stoppages, and a uniform speed of 9½ miles per hour, no truck had to pass another. Fast cars passed sections when the traffic in the opposite direction permitted. In rush hours this was impossible, as sections were longer than the intervals. On one occasion, an entire army corps was moved up to Verdun in ten hours. (Numbers regarding trucks and strength of corps deleted by censor). This heavy work was carried on for five months without a hitch.

The whole of the region occupied by the Second Army was divided into two main sections, each under a traffic director, who was responsible for all details necessary to keep the transport going.

One-way routes were established where possible. Some roads were restricted to trucks alone. Others had both motor and horse-drawn vehicles, still under the section system of five trucks and eight horse-drawn vehicles. Some roads to important batteries were closed except to the ammunition trucks for their service. Some poor roads were allowed to be used only by four-wheel drive tractors. Certain roads were closed absolutely during daylight on account of danger. Supply trucks carried ammunition directly to the batteries, or to dumps in rear from which it was carried forward by horse or hand.

Certain roads were closed to all vehicles, small groups of men only being allowed to use them. Other roads were closed to all except staff cars and ambulances, running singly.

During the attack, the civilian population were ordered out of Verdun, thus throwing an additional strain on the truck service. Later as much as possible of the household furniture was salvaged. Gangs of soldiers prepared the furniture and the motor trucks removed it at night.

This intense traffic had to be carried on during the most unfavorable time of the year as regards weather. There were available for use into Verdun one third class road, reserved for motor traffic, one national highway, and a number of minor roads about like the aver-

age American dirt road. The two main roads were under frequent shell fire. The repair problems were serious on account of the enormous traffic. Road repair men were stationed at intervals of 20 yards, with orders to fill holes as fast as formed. The only rolling was that done by the traffic. Wreckage of buildings was frequently utilized to fill shell holes. The method of repair proved satisfactory. Chains were not allowed to be used on the wheels.

The repair men widened the road wherever possible, and bridges were widened to the full width of the road.

Aside from damage by shell fire, about 10 per cent of the trucks were under repair. Altho trucks were run in sections of five, the real unit was twenty trucks, one of which towed a kitchen and another carried spare parts and tools. One complete truck workshop was attached for every 80 to 100 trucks.

MOTORS

See also

AERONAUTICS—MOTORS
DIESEL ENGINE

[Why Weakening the Field of a Shunt Motor Will Increase Its Speed. By Elec. Sergt. 1st Class T. A. Lemaster, C.A.S.D. *Jour. U. S. Artill.*, May-June, '16. 750 words. 1 diag.]

(This is a technical electrical article and does not well admit of digesting. In it is given a simple explanation and arithmetical proof of why weakening the field will increase the speed of a shunt motor.)

MOUNTAIN ARTILLERY

See also

MOUNTAIN WARFARE

—Matériel—Howitzers

Austria

[The Austrian Mountain-Howitzer, 10 Centimeters, Model of 1916. By Maj. D. Pedro de Obregón. *La Guerra y Su Preparación*, Mar, '17. 825 words. 7 photographs.]

The Austrian mountain howitzer, model of 1916, has the following characteristics: recoil on cradle; hydraulic check; spring counter-recoil; independent line of sight; protecting shield; maximum angle of elevation, 70 degrees; maximum range 8000 meters. The shrapnel fired by this piece contains 480 balls of 9 grams, and the fuse is graduated to 7600 meters. The shell-shrapnel, containing balls of similar number and weight, has a fuse graduated to 7800 yards. Used as shrapnel, it bursts in air, leaving a white cloud, but the head continues its flight, bursting on impact and producing a black cloud. Its use as shrapnel is recommended against troops, batteries with shields, and trenches. Used to burst on impact, this projectile has more effect than ordinary shrapnel, as the explosive charge in the base adds its effect to that of the charge in the ogive. This use is recommended against structures not too substantial. The metallic cartridge is separate from the projectile and the amount of powder therein can be regulated by inserting it in the form of discs which are held in place by a cross piece, a washer and a spring.

For maneuver the piece is separated into carriage, cradle, and gun. Each part is transported on two wheels, and is drawn by two horses. A fourth cart drawn by one horse carries provisions, baggage and tools. Four pack horses carry the ammunition in boxes. A fifth pack horse carries the maneuvering ropes, observation instruments, intrenching tools, and a telephone installation. To each battery there is assigned a rolling kitchen of three pots, capacity 140 rations, drawn on two wheels by one horse.

MOUNTAIN WARFARE

See also

MOUNTAIN ARTILLERY

[Frontier Mountain Warfare. By Major Ivan Battye, D.S.O., Q.V.O., Corps of Guides (F.F.). *Jour. United Service Institution of India*, April, '17. 8000 words. (Continued from January issue.)]

(This is a discussion in amplification of the Field Service Regulations, showing wherein the operations against the Pathan tribes require modifications from the normal procedure. Thus the regulations concerning the work of the engineers do not apply in operations against an enemy in no wise dependent upon civilized means of communication. Cavalry is of great value, but its action must be entirely dismounted.

In this installment, the subjects of Rearguards, the Attack, and Raids and Counter-raids are discussed. Retirements must be conducted with care and attention to detail, because some of the frontier tribes are inspired with reckless courage in following up a retreating foe. Procedure is given in detail. In the attack, superior armament, discipline and organization make greater risks justifiable than could be taken against a better organized enemy. Intrenching tools are rarely necessary or desirable. Formation and ammunition supply are touched upon. Pursuit is more by means of fire than by actually following the enemy.

The "raid" is one of the favorite forms of warfare with the Pathans on the borders. These are usually sudden and secret descents upon a particular village promising good booty. Counter-raids are raids by our own troops in reprisal, and they are not much in favor with the soldiers of a great Empire.

Various examples of raids are given and a typical raid is described. It is difficult to prevent raids or to capture or punish the raiders. One of the most effectual preventives is a chain of posts, small forts, or blockhouses, suitably garrisoned. Sometimes villagers are armed. Movable columns are also effective, as are blockades and "round-ups.")

MULES

See also

ASSES
HORSES

MUNITIONS AND MUNITION MATERIALS

See also

AMMUNITION

MUNITIONS—Continued

EUROPEAN WAR—MUNITIONS AND MUNITION MATERIALS
EXPLOSIVES
POWDER

—In European War

See

EUROPEAN WAR—MUNITIONS AND MUNITION MATERIALS

—Manufacture of

[The Manufacture of Munitions. Quoted from various sources. *Memorial de Artilleria,* Nov, '16. 8500 words.]

For some time the foreign publications which we have received have reported on the efforts made in certain countries to intensify the production of munitions. In some cases these are purely speculative as in the case of the United States; in others they are due to necessity in the cases of those nations actually engaged in the war.

Thus, for example, in reference to the United States, the technical publications have given us eighteen photographs taken day by day. The first shows us the bare ground on which it is proposed to construct the shop, taken the first day. The last one, taken the eighteenth day, shows us the completed shop, normally at work and producing a large number of projectiles.

With reference to England, admirable efforts have been made to emancipate that country from dependence on the United States. The shops or factories of more or less importance may be counted by the hundreds and thousands, all of which have been erected in an exceedingly short time. Photographs are shown of plants in which the steel bars enter one side of the building and pass out the other side finished projectiles.

In a similar manner we find that in France the production of munitions has received a great impulse. *La France Militaire* recently published some data concerning one of these improvised factories which demonstrates how the energies of a people who wish to live may be utilized in obtaining this end. The factory in question was constructed very hurriedly shortly after the beginning of the war. It was organized to produce mechanically, 10,000 rounds of field gun ammunition of 75 mm. caliber, complete, or 10,000 projectiles, 10,000 fuses, and 10,000 cartridge cases. The machinery was obtained from Switzerland and the production began within forty-eight hours after the building had been completed. At the present time the production of this factory, daily, is as follows:

Projectiles of 75 mm. caliber	25,000
Projectiles of 155 mm. caliber	1,000
Cartridge cases for 75 mm. gun	25,000
Fuses	40,000

In the production of the above 91,000 elements which of 11,700 is employed, of which 51 per cent. are go make up the ammunition, we find that a personnel women. It is stated by the review above quoted that this factory, as in the case of all others, works continuously for twenty-four per day, three shifts being employed. It has been found that eight-hour shifts or reliefs give the most efficient results.

[The Munitions Supply (conclusion). By Dr. A. V. Blom. *Schweiz. Monatschrift aller Waffen,* Sept, '17. 500 words.]

From the available raw material in the world, over 2½ million tons of explosives can be manufactured yearly. About four-fifths of this is being expended on the French front. It follows that if we have to protect a front of 60 km., we must produce yearly about 100,000 tons of powder and high explosive. To obtain the necessary nitric acid from the atmosphere requires over 200,000 horse-power years. The roundabout method from ammonia requires 70,000 horse-power years. Therefore the production of lime nitrogen will be economical. Besides, after the war it can be used as fertilizer. We still lack an apparatus for the combustion of the ammonia, but the initial cost will not be great. The excess energy of water-power works can be used to produce hydrogen. Celulose can be procured from our forests, which can produce 4 million cubic meters of wood yearly. The question of tar oils is more difficult. The normal production from gas-works is 15,000 tons, sufficient for 400 tons of explosives. This can be increased tenfold by the distillation of the coal and the extraction of benzol, but this would be insufficient. Luckily we can produce yearly several thousand tons of chlorate and perchlorate, and as these require only 2 horse-power years per ton, the expenditure of water power will not be excessive. I have already mentioned the necessity of investigating the production of sulphuric acid from gypsum. We can do without glycerin.

From the foregoing, it appears how important is the solution of technical problems, both for the production of munitions and for the production of food. In respect of organization for this purpose, Germany has furnished an example for the world.

—Manufacture of—Accidents

[Note. *Army & Navy Jour.,* Jan 27, '17. 350 words.]

Three recent explosions in munition plants have caused an enormous loss of materials and some lives. At a chemical plant in the east end of London, an explosion on Jan 19, killed 300 persons and left on the former site of the "explosive store" a hole a hundred yards in diameter and eighty feet deep.

Explosions in the plants of the Canadian Car and Foundry Co., at Kingsland, N. J., Jan 11, caused the $320,000, the amount of powder destroyed being 400,000 pounds.

On Jan 12, the plants of the E. I. du Pont de Nemours Co., at Haskell, N. J., suffered a loss of destruction of about 500,000 shells and buildings to the value of $16,750,000.

—Manufacturing Facilities for

Canada

See

LINDSAY ARSENAL

France

See also

EUROPEAN WAR—AMMUNITION—SUPPLY—FRANCE
FIELD ARTILLERY—HEAVY—UNITED STATES. (Article: "French Gun Factories, etc.")

[French Factories of Artillery and Munitions. By Cols. D. Francisco Echague and D. Juan García Benítez. *La Guerra y Su Preparación,* March, '17. 9000 words.]

The combatant power of the French army has augmented in a formidable maner in recent months. At the beginning of the war the French were surprised with a terrible scarcity of munitions and of heavy artillery. The augmentation of production has had to contend with lack of laborers, many of whom were sent to the front. Finally, however, it was realized that specialists were more needed in the factories, and they were returned to that duty.

Altho France lost, at the beginning of the invasion, forty per cent of its coal, four-fifths of its steel, eighty per cent of its metallurgical machinery, and 60,000 of its 112,000 laborers in these industries, still, by organization of its labor, it was, in the beginning of 1915, able to produce munitions for Russia. Today France has myriads of factories, employing 1,000,000 laborers, one-fourth being women. The production of projectiles of 75 mm. has increased forty times, large caliber projectiles ninety times, pieces of 75 mm. thirty times, machine guns one hundred and seventy times, powder seven times, other explosives forty times. France supplies all the Allies except England.

Private metallurgical works have devoted themselves to the production of the munitions to which the machinery already installed was most applicable. The automobile factories, besides producing motors for aircraft and tractors and trucks for the army, began making projectiles bored cold from cylinders which the factories had in abundance. Later forges were acquired and the system of die forging was adopted. All arsenals and factories have been much expanded. It would appear that the expenditure involved will be wasted after the termination of the war, but this is not so, as the factories can be transformed for peaceful pursuits. For example, the powder factories can be transformed into dye works.

French labor has been reinforced by Chinese, Cambodian, Moorish and Spanish contingents. Foreigners receive five francs per day and lodging. The most important innovation is the use of women in the factories. Women are more skillful in minute work. They, almost exclusively, are the employees in the cartridge, powder, and fuse factories, and many are employed otherwise. The minimum daily wage of women is five francs, with an addition for excess production. The consequence will be a serious problem when peace is restored; in order to attract the women from the factories to maternity, the State will have to pass laws for their compensation during the period of gestation. This will be necessary to replenish the population.

A great variety of artillery matériel is produced, but seemingly without confusion. Many new pieces are in use, and trench warfare has made available many models out of date because of slowness of fire. All the fortress, coast and naval artillery has been taken to the front. Where the weight was excessive, the pieces have been shortened without unduly decreasing the range. The French heavy artillery consisted of the 120 short, 120 long, 150 short, and 155 Rimailho, with siege mortars (principally 270). Others have been added. Those of most value for a campaign of movement are the new medium caliber pieces: the 105, a piece of great rapidity and range; the 150 Schneider howitzer, and the 155 short. The heavy pieces which predominate are the 155 rapid fire long, the 220 and 280 mortars, and the 400 howitzer; the latter is mounted on trucks for fire from railroad tracks. There is also a 520 howitzer. Altho an enormous quantity of projectiles is produced by die forging, they have also reverted to the process of casting.

The Schneider works are at Havre and Harfleur. Their most interesting products are the 75 trench mortar, the 155 gun, the 120 and 155 howitzers and the 280 mortar. The trench mortars were at first improvised pieces, firing shells made in the trenches; later a mortar of 58 mm., which fired aerial torpedoes predominated, but the velocity was so slow the enemy could see the projectiles leaving the pieces. Later the 75 was adopted, which fires the defective shells which cannot be used in the 75 gun. It is mounted on a small platform which can be easily mounted on an axle with two wheels, which are separated by the recoil. The charge varies, the maximum being 70 gm.; it is contained in a 10 cm. case. The maximum range is 2000 meters. The mortar has a sliding breech block. The total weight of the piece is 400 kgms. An improved type has a maximum range of 8000 meters. Another model has a split trail, and the trunnions are near the breech. The arrangement facilitates high-angle fire.

The 155 gun is the old piece on a new carriage. Two wagons are employed in transportation. The piece may be displaced laterally, and has an angle of elevation of 37 degrees. The charge is in two parts. The range is 13.5 kilometers. The 120 howitzer is of the same type as the well-known Schneider howitzers of 105 used by the Belgian and Serbian artillery. The 155 howitzer is regularly in use in the French army.

The 280 mortar is 12 calibers long. It is transported on four wagons. The projectile weighs 75 kgms.; the initial velocity is 320 meters; the angle of fire is 65 degrees; the maximum range is 6.5 kilometers. Loading is by means of a derrick and a shot-truck.

The fuse shops employ 9000 laborers. The shops are isolated by thick walls to localize the effect of

MUNITIONS—Continued

bombardment by airplanes. The gun factory employs 3000 laborers. It receives the tubes from the Creusot works.

The Renault automobile factory produces daily 10,000 shells of 75 mm. and 800 of 155. The factory also constructs military trucks and tractors, motors for air-craft, and breech blocks of artillery and of rifles. The ordinary trucks have a capacity of three tons, but a new type can carry 18 tons. It has an engine of 70 h.p., has both axles movable, and carries a capstan, driven by the motor of the truck for the maneuver of guns. The airplane motors have 200 or 300 h.p. with eight or twelve cylinders. The shops employ 18,000 laborers.

The Citroen factory of 75 mm. projectiles (shrapnel) is the most perfect type of factory improvised since the declaration of war, and is a model of organization of labor. It produces daily 50,000 projectiles of which 10,000 are for France and the remainder for England, Italy, Russia and Rumania. It employs 14,000 laborers. The steel is received in cylindrical bars from the United States, and in this factory undergoes all the processes necessary in the manufacture of the complete projectile, except that the bursting charge is not inserted in this factory. The shrapnel balls are made of lead with 10 per cent of antimony. The shop produces 10,000,000 daily. The complete manufacture of a projectile takes 25 minutes. The factory has a reserve of steel for six months, having consumed 500 tons per day.

The laborers are paid in proportion to production. Women do all the minute work. There are three shifts which work at night. In order to prevent delay, each laborer is paid on Saturday the nearest multiple of ten francs below what he has earned, the balance being added to the account of the following week. There is a pay window corresponding to each multiple of ten francs so that a laborer, for example, who has earned 50 francs goes to the 50 franc window and the tellers do not lose time in counting.

The Bourges artillery foundry is a government institution, employing 9000 laborers for the production of the 75 and the 155 guns. The mechanism of the 75 was at first kept secret but has now become public. In order to produce interchangeable parts, all the 75's were at first produced at Bourges, but in view of the great consumption in the field, it has been necessary to have recourse to private industry for the tube, the carriage, and the recoil check. All of these parts are however sent to Bourges to be assembled. The piece is similar to all the modern field pieces which recoil on a cradle and have a hydraulic check.

An important industry of the factory is the repair of pieces worn out or damaged in service. In the enormous gun hospital it was apparent that the time fuse in the explosive shell which produces explosion above the target causes more damage in matériel than explosion on percussion. The number of shots fired by a piece before it is returned for repairs has been as high as 22,000. The rapidity of fire has more influence than the number of shots. Six weeks are employed in the manufacture of a gun.

The machine guns come from Chatellerault and St. Etienne but the accessories are manufactured at Bourges. A few mountain guns of 65 mm. are manufactured here, but have little use in this campaign. The piece has a differential check for short recoil and springs which assist the check, while the check in modern pieces is integral. The piece has proved defective in Morocco. At Bourges is also manufactured the 155 Bange piece, which has slow fire and is mounted on a platform with an inclined plane for the return into battery after firing. The form of the collar has been changed, the trunnions have been removed, and the piece has been placed on a Schneider carriage for recoil on a cradle. This improvement has made it a rapid fire piece, but many of the old type are still in service at the front. Shells of 65, 75, 80 and 90 mm., powder charges, fuses, primers, are also manufactured here. At Bourges we saw exhibits of all of the shells in use, viz.: 520, 400, 370, 293, 280, 270, 220, 155, 120, 75, 65, and 37.

The Navy Steel Works principally at St. Chamond, are the most important in France except the Creusot works. There are 18,000 laborers. The Martin furnaces produce 200 tons of steel daily. The artillery produced comprises principally adaptations for the field of naval guns, such as the 75. The other important types are: the light howitzer of 105 mm., 12 calibers long, rotating breech block, projectile weighing 14 kgms., range 6200 meters, firing 15 shots per minute; the 155, 16.9 calibers, projectile 43 kgms., range 11 kilometers, 6 shots per minute; the 120 gun, projectile 20 kgms., range 15 kilometers; (in the latter two the breech block closes automatically by a spring actuated by the flange of the case as it enters the breech); the 145 gun, range 18 kilometers, on the carriage of the 155, with a view to substituting the 155 when the gun is worn out; the 240, mounted on a carriage which is transported on a truck for fire from railroads, some of which were employed in the last Somme offensive. Guns of different calibers, but of similar mechanism, are grouped together for manufacture, instruction, and service, with a view to zone fire. Thus the 120 long is grouped with the 155 short, the 105 long with the 120 short. The means of transportation of the different guns of the same group are the same, *i.e.*, horse, tractor, narrow gauge rail, or standard gauge rail.

The Navy Steel Works also manufacture the "tanks" (infra), forged and cast steel shells, and fuses.

The largest French shrapnel is the 150; the Italians have a 240 shrapnel, and we were informed that at Verdun the Germans had fired a 305 shrapnel against convoys and rearguards.

The "tank" is a new automobile, armored and armed, which is so constructed as to be able to move off the roads, and to cross trenches and obstacles of slight relief. Each carries a gun, several machine guns, and a garrison, and is proof against bullets and shell fragments. The purpose is to accompany the infantry

in the attack, and to precede it in the crossing of enemy trenches, in comparative immunity since artillery fire directed against it would damage the trenches themselves. There have been no official reports of the efficacy of the tanks; popular rumor has ascribed every result from complete success to utter failure. The fact that the tanks have not been mentioned recently would indicate fiasco, but nevertheless the English talk of their future employment, and the French are manufacturing an improved type.

The French tank lacks the rear train of wheels, which apparently serves as a rudder, of the English model, and is smaller. The movement of both is produced by an endless chain over pulleys and rollers. Petroleum motors drive the pulleys, which are attached to the body of the vehicle by springs which enable it to be accommodated to accidents of the terrain. The ability to cross narrow trenches is due to the fact that the center of gravity of the tank is well to the rear. The French tanks have a 75 mm. gun in front with lateral apertures for machine-guns; the English have lateral caponiers for light pieces.

At the branch establishment of the Creusot works at Chalons sûr Saône there is a shop where disabled pieces are sent from the front, and where new pieces are constructed from the serviceable parts of the damaged pieces. This factory also produces the 105 mm. and other projectiles, bridge elements, and other metallic construction. All naval work is suspended.

The principal Schneider factory is the well-known Creusot, which is a competitor of the Krupp works. It possesses the necessary machinery for the production of armor plate and of the most powerful naval guns, which are its principal product in time of peace. The electrical generating plant develops 15,000 h.p. from the energy produced by the gases from the furnaces. Coal from mines belonging to the company produces the coke and the gas, from which are derived the tar, the ammoniacal oils and the benzol, a product which is sent to the explosive factories. At present the preparation of armor has ceased and all efforts are concentrated on the manufacture of guns and projectiles. For this purpose it has been necessary, since the beginning of the war, to make extensive additions to the plant.

This factory produces an enormous quantity of pieces and projectiles of a multiplicity of calibers. We saw the following projectiles: 520 mm., gun 18 calibers long, range 18 kilometers, weight 190 tons with carriage and truck; 400 mm., howitzer, for fire from railroad; 370 mm., for a naval gun reduced to a howitzer, weight of projectile 400 and 500 kgms., fire from a platform on the railroad; 340, 320 and 305, for naval guns similarly adapted to the field; 293 mm., for naval gun which had been manufactured for Denmark; 280 mm., for new model Schneider mortar; 240, for naval gun and howitzer, for fire from railroad; 220 mm., modern Schneider mortar, recoil on carriage; 194 mm., for old type of naval and coast gun; 155 mm., for Rimailho gun, modern howitzer, and two types of long gun, the last three being Schneider models; 145 and 140 mm., for long naval guns; 120 mm., for long and short guns; 105 mm., for modern field gun; 75 mm., for regulation field gun and new cavalry model; 65 mm., for regulation mountain gun.

Before the war, all pieces had to be sent to the rear, or even to the foundry, for repairs. At present much of the work is done at the front, with great saving of time.

At the powder factory of St. Ausone we saw the black powder mills, and next the schneiderite works. This is composed of ammonium nitrate and dinitronaphthaline. They receive the former and manufacture the latter, transforming the naphthaline into mononitronaphthaline and then into dinitronaphthaline. The factory also produces guncotton, and, in small quantities, tolite and nitrotoluene.

The factory produces nitric acid in three ways: from sodium nitrate, from calcium cyanamid, and from nitrogen of the air.

The cartridge factory of Toulouse (12,000 laborers) produces daily 12,000 cases of the 75 mm. projectile and 2000 of the 155. Other shops produce cartridges and bullets. France has eight factories for the production of the latter, with a capacity, in all, of 200 million cartridges per month. The cartridges carry 2.85 grams of American, and 3 grams of French, powder. Loading by hand is preferred as more accurate than machine loading. The ball contains 90 per cent copper and 10 per cent zinc. The factory also loads daily 30,000 primers for the 105 gun. At the time of our visit there was an immense heap, said to contain 14 or 15 million, of cartridge cases of guns of various calibers awaiting reloading. The cartridge factory can produce 500 million cartridges annually, but the production of rifle cartridges has been reduced, as the consumption is negligible. We were told that at Toulouse there was also a powder factory where powder B (a trinitrocellulose) is produced, the 30,000 laborers producing daily 100 tons.

[New War Matériel of the French Army. Editorial. *La Guerra y Su Preparación,* March, '17. 50 words. 16 photographs.]

(The accompanying photographs, furnished by the French War Ministry, show the work accomplished since the beginning of the war, and the development of military industry.)

Germany

[Use of Aluminum in Germany. *Scientific American,* Feb 10, '17. 100 words.]

Owing to the mining of coal in occupied French territory by forced labor, it is said that the Germans are able to produce aluminum very cheaply and are using it extensively. In motor construction it is used for crank cases, gear boxes, cylinder heads, jackets and shafts. Cheap production of electricity has stimulated the development of electric motor vehicles run with nickel-iron batteries, owing to the shortage of lead.

Great Britain

See also
European war—Ammunition—Supply—Great Britain

MUNITIONS—Continued

[Overproduction of Munitions in Great Britain. *Scientific American,* Feb 10, '17. 100 words.]

There are more than 4623 government-controlled munition plants in Great Britain engaging 2,225,000 employees. As the maximum point in gun and shell production has been reached, there will be a gradual return of plants to domestic production and export.

[Growth of Munitions Output. *Scientific American,* Feb 10, '17. 125 words.]

The relative outputs of British munitions in June, 1915, and December, 1916, are as follows: Heavy howitzers, 1 to 323; field howitzers, 1 to 46; medium caliber guns, 1 to 66; 60-pounders and 6-inch guns, of which the manufacture has been curtailed because the supply is too great, 1 to 12. The output in a single day of shells for heavy guns, and in a week of shells for field howitzers and 3-inch guns, equals the output of these shells during the whole first year of the war.

[Redundant Factories. *Arms and Explosives,* June 1, '17. 500 words.]

The whole-hearted financial support of the new ally (United States) has rendered unnecessary certain contemplated steps looking toward a reduction in (British) dependence upon imported munitions. This had been a source of acute anxiety.

The principal difficulty is to avoid the continuance of work undertaken with great enthusiasm but rendered unnecessary by later developments. Much has been done as a precaution against shortage, perhaps when there was never a real danger of it. Great as is the cost of a factory, the cost of running it when not needed is greater than that of shutting it down. The pruning knife must be used remorselessly.

["A Cartridge-Case Costs 7s to Produce and 4d to Re-form." *Sphere,* July 14, '17. 400 words. Illustration.]

Dr. Addison. Minister of Munitions, made a speech in the House of Commons on June 28, giving an account of the work of the department and emphasizing the necessity of a vast and unceasing supply of shells and guns to the army in the field.

"There were endless difficulties over obtaining an efficient detonator, difficulties over gauges, and above all over different types of fuses, with a perpetual shuffle against duds on the one hand and prematures on the other." But not only has increased output been obtained, but also improved quality. The battle of the Somme showed fifteen times less proportion of premature explosions of shells.

An extensive salvage department has been established. Shells are collected at the front, returned to England, re-formed and reloaded. A new shell costs $1.75 to make a new case and 15 cents to re-form one, so the economy is obvious. A shell can be re-formed four times. The output of machine guns and small arms has been greatly increased, and Great Britain is the equal, if not the superior, of any in the matter of munitions.

[Munitions and Miracles. *Army & Navy Gazette,* July 7, '17. 500 words.]

Dr. Addison's statement in the House of Commons June 28 shows the wonderful achievements of the Ministry of Munitions. To-day a much greater number of men and women are employed, but the output is greater and the actual cost has been sensibly reduced. There are being turned out 28 times as much high explosives as were made a year ago; the quality of shells has been greatly improved; the small arms output has been increased tenfold and all necessary small arms ammunition is now made at home; the output of machine guns is 20 times what it was two years ago; tanks of both sexes are being manufactured; we (British) can make our own potash and optical glass. Best of all, the industries built up during the war will be available for peace purposes.

United States

See also

United States—Munitions—Manufacturing facilities

[The Machinery of War. By Howard Coffin, Member of the U. S. Naval Consulting Board. *Independent,* Apr 21, '17. 700 words.]

The Council of National Defense is trying to treat the problems of war as the problems of everyday business activities are treated. The work of accelerating the flood of materials from this country to the Allies, of accomplishing our own tremendous building program to supply the Army and Navy, and of organizing our industries and resources so as to meet the great strain put upon them, must be achieved without destroying existing business organizations that have been built up thru a long period of years, and without weakening our industrial units for important demands of peaceful commerce after the war.

Our aeronautics industry furnishes an illustration of the situation. In order to supply the great demand for airplanes we might take our automobile factories to become airplane factories. But the result would be the disruption of elaborate sales organizations, confusion, financial ruin to many people, and leaving the automobile industry at the end of the war without sales machinery. Automobile building equipment should, therefore, be converted into aeronautic equipment by carefully considered percentages. It is possible to convert twenty-five per cent of such equipment into the making of airplanes, thus supplying the necessary machines without weakening the concerns involved.

[National Defense Conference. *Army & Navy Jour.,* May 5 '17. 450 words.]

American troops that go to France will have to use Allied guns and ammunition, as the Allies are manufacturing to-day more munitions than they can use. Rifles are being turned out at the rate of 17,000 to 20,000 a day with more ammunition than the whole world can use; but most of the big guns are needed by the Allies and more big-gun factories must be created. The country will need more airplanes than it can possibly

manufacture, but on the other hand, more automobiles are now being manufactured than the country can possibly use. These matters will be adjusted.

[Our Field Arms and Ammunition. *Army & Navy Jour.*, July 7, '17. 400 words.]

Secretary Baker has informed the Senate, in response to a resolution, that it was contemplated to use eventually ammunition of French type for most caliber guns, which course conditions of supply and manufacture render practicable; that we would use the U. S. ammunition in both the Springfield and Enfield rifles; that the same ammunition would be used in our machine guns; that U. S. ammunition could not be used in the rifles or machine guns of the French or British armies, being of a rimless type; and that it would be highly advantageous if the ammunition were interchangeable, but that types differed because developed along independent lines.

MUSIC, Military

See also

BANDS, MILITARY

MUSKETRY

See

INFANTRY—FIRE—INSTRUCTION AND TRAINING—TARGET PRACTICE

NAPOLEONIC WARS—1813-15

[The Prussian Enemies of Napoleon. By V. Kaiserov. *Voenny Sbornik*, June, '16. 4500 words. (Concluded.)]

Gneisenau was at Leipzig during the great battle at that place in the autumn of 1813, and followed its course very closely. Letters from him to his wife exist, written at the end of the first day's fighting, in which he expressed his confident hope that victory would crown the efforts of the Allies, and these were supplemented on the following day by additional letters reciting the fulfillment of Gneisenau's expectations. Gneisenau was of the opinion that the proper course for the Allies to take after their defeat of the French in middle Germany was to follow up and cross the Rhine, and he was especially anxious to have the Prussians advance and seize the Low Countries, but in this he was not at the time successful. One reason for this was the possible one that the Prussian army of Yorck contained only 11,000 men at the end of 1813. Later Gneisenau recommended that the efforts of the Allies be concentrated on an advance on Paris, and the Prussian troops were during the winter brought into France reaching Nancy.

(The remainder of this article is a succinct account of the campaigns in France in 1814, and in Belgium in 1815. Nothing new is brought out in this account that has not already been fully covered by other and more complete works. Gneisenau's part in this fighting as an army commander in 1814 and as chief of staff to Blücher in 1815 is touched upon, and Gneisenau's error in the earlier campaign in consistently overestimating the strength of Napoleon's forces, but as a whole the criticisms of the campaigns treated are few and of little value.

The article concludes by mentioning that Gneisenau was promoted to the rank of field-marshal in 1825, and that he died from cholera in 1831.)

NATIONAL ARMY (U. S.)

[Draft Totals Allotted Each State and Territory. *Official Bulletin*, July 13, '17. Quoted.]

The Secretary of War to-day made public thru the Provost Marshal General's Office the following statement giving the total number of men to be drafted, together with the proportion to be drawn according to the population of each State and Territory and the District of Columbia:

Area.	Net Quota.
United States	687,000
Alabama	13,612
Arizona	3,472
Arkansas	10,267
California	23,060
Colorado	4,753
Connecticut	10,977
Delaware	1,202
District of Columbia	929
Florida	6,325
Georgia	18,337
Idaho	2,287
Illinois	51,653
Indiana	17,510
Iowa	12,749
Kansas	6,439
Kentucky	14,236
Louisiana	13,582
Maine	1,821
Maryland	7,096
Massachusetts	20,586
Michigan	30,291
Minnesota	17,854
Mississippi	10,801
Missouri	18,660
Montana	7,872
Nebraska	8,185
Nevada	1,051
New Hampshire	1,204
New Jersey	20,665
New Mexico	2,292
New York	69,241
North Carolina	15,974
North Dakota	5,606
Ohio	38,773
Oklahoma	15,564
Oregon	717
Pennsylvania	60,859
Rhode Island	1,801
South Carolina	10,081
South Dakota	2,717
Tennessee	14,528
Texas	30,545
Utah	2,370
Vermont	1,049
Virginia	13,795

NATIONAL ARMY (U. S.)—Continued

Washington	7,296
West Virginia	9,101
Wisconsin	12,876
Wyoming	810
Alaska	696
Hawaii	...
Porto Rico	12,833

—Camps of Instruction

[Disposition of 687,000 Men To Be Drafted Into Army Arranged by Provost Marshal. *Official Bulletin*, Aug 21, '17. Quoted.]

The Provost Marshal General has recommended, and the Secretary of War has approved, the following disposition of the 687,000 men to be drafted into the service:

American Lake, Wash.—Alaska, 696; Washington, 7296; Oregon, 717; California, 23,060; Idaho, 2287; Nevada, 1051; Montana, 7872; Wyoming, 810; Utah, 2370. Total, 46,159.

San Antonio, Tex.—Texas, 30,545; Oklahoma, 15,564. Total, 46,109.

Fort Riley, Kan.—Kansas, 6439; Missouri, 18,660; South Dakota, 2717; Nebraska, 8185; Colorado, 4753; New Mexico, 2292; Arizona, 3472. Total, 46,518.

Des Moines, Ia.—North Dakota, 5606; Minnesota, 17,854; Iowa, 12,749; Illinois, part, 9503. Total, 45,712.

Louisville, Ky.—Kentucky, 14,236; Indiana, 17,510; Illinois, part, 10,134. Total, 41,880.

Rockford, Ill.—Wisconsin, part, 7171; Illinois, part, 32,016. Total, 39,187.

Battle Creek, Mich.—Michigan, 30,291; Wisconsin, part, 5205. Total, 35,496.

Chillicothe, O.—Ohio, 38,773; Pennsylvania, part, 4000. Total, 42,773.

Little Rock, Ark.—Arkansas, 10,267; Louisiana, 13,582; Mississippi, 10,801; Alabama, 5692. Total, 40,342.

Atlanta, Ga.—Tennessee, 14,523; Georgia, 18,337; Alabama, part, 7920. Total, 40,785.

Columbia, S. C.—South Carolina, 10,081; North Carolina, 15,974; Porto Rico, 12,833; Florida, 6325. Total, 45,213.

Petersburg, Va.—Virginia, 13,985; Pennsylvania, part, 24,000; West Virginia, 9101. Total, 47,086.

Annapolis Junction, Md.—District of Columbia, 929; Pennsylvania, part, 32,859; Maryland, 7096. Total, 40,884.

Wrightstown, N. J.—New Jersey, 20,665; Delaware, 1202; New York, part, 20,241. Total, 42,108.

Yaphank, N. Y.—New York, part, 43,000.

Ayer, Mass.—Maine, 1821; New Hampshire, 1204; Vermont, 1049; Massachusetts, 20,586; Connecticut, 10,977; Rhode Island, 1801; New York, part, 6000. Total, 43,438.

—Officers

[Note. *Army & Navy Jour.*, July 7, '17. 200 words.]

The War Department has approved recommendations of regimental commanders which will result in commissioning as captains and lieutenants in the first quota of the National Army 3000 or more non-commissioned officers of the regular army. Others, in addition to those now in training camps, will be commissioned for the period of the war.

A regular officer will command each regiment of the National Army, and he will have his adjutant, ordnance officer, quartermaster, and at least one major from the regular army. Reserve lists, training camps, and the ranks of the regulars will furnish the rest.

NATIONAL GUARD (U. S.)

See also

MEXICAN BORDER MOBILIZATION (1915-17)
UNITED STATES—MILITARY POLICY OF—COMPULSORY MILITARY SERVICE
UNITED STATES—ARMY—RESERVE

NAVAL ARTILLERY

See also

ARTILLERY—USE OF IN EUROPEAN WAR

NAVAL OPERATIONS

See also

AERONAUTICS—NAVAL USE OF
COAST ARTILLERY
COAST DEFENSE
DIRIGIBLES—NAVAL USE OF
EUROPEAN WAR—GENERAL NOTES ON OPERATIONS, BY THEATERS—NAVAL OPERATIONS
SHIPS AND SHIPPING (MERCHANT)
TORPEDOPLANES

[The Naval History Essay for 1916. The Naval Operations in the Mediterranean, 1793-1801. By Lieut. John S. Mackenzie Grieve, R.N. *Jour. R. W. S. Institution*, Aug, '17. 5000 words.]

(A detailed account of the operations in the Mediterranean during this period.)

Japan

[Japanese Shipbuilding. *Army & Navy Gazette*, Jan 13, '17. 300 words.]

Whereas at the time of her war with Russia Japan had in her fleet only foreign made armored ships, to-day she is not only able to construct all her own vessels, but is undertaking contracts for her allies. She is to construct ten destroyers of 600 tons, also some submarines having a displacement of 1070 tons, a length of 246 feet and a cruising radius of 6000 miles.

—Attack

See also

DARDANELLES, OPERATIONS AT THE (1915)

—Attack—Coast Defense Against

See also

COAST DEFENSE—AGAINST NAVAL ATTACK

—In European War

See

EUROPEAN WAR—NAVAL OPERATIONS

—Suppression of Piracy

United States

[Our Navy and the West Indian Pirates. By Rear-Admiral Casper Goodrich, U. S. Navy. *Proc. U. S. Naval Institute,* July-Aug, '16. 7,000 words.]

(Admiral Goodrich deals with the history of piracy as practiced in the four quarters of the globe. The U. S. Navy did much to suppress piracy in the more remote parts of the world, for example in the Mediterranean Sea and in Chinese waters, but many conflicts occurred in our own West Indies and these occupy the place of importance in an interesting historical narrative.)

NAVY

See also

COAST ARTILLERY
MARINES
NAVAL OPERATIONS
SANITARY SERVICE—NAVAL MEDICAL SERVICE

—Naval Situation

See also

UNITED STATES—NAVAL POLICY OF

—Ships and Matériel

See also

SUBMARINES
TORPEDOES—NAVAL

—Strategy

See also

AERONAUTICS—NAVAL USES OF

NEUTRALITY

See also

BELGIUM—PRESERVATION OF NEUTRALITY

NEW ZEALAND

—Army—Engineers

See

SOMME, BATTLE OF THE—ENGINEERING OPERATIONS (Article: "New Zealand Engineers on the Somme")

NIEUPORT AIRPLANE

[The Nieuport 1½ Planes. *Aerial Age Weekly,* Oct 8, '17. 700 words. Illustrated.]

An immediate step in the transformation from the monoplane to the biplane is formed by the biplane with a larger top plane and a smaller bottom plane. This type produced by the Nieuport firm has speed and ease of handling, which is characteristic of the monoplane, and stability and short wing span, which is found in biplanes. On account of their greater climbing power speed and maneuverability they are superior to the larger machine, not only as regards attack from the ground, but also in case of attack from hostile aircraft. The Nieuports may be divided into three main types: Type 11, a single-seater with rectangular body up to the engine cowl, and the cowl covering the upper end of the motor only; Type 12, which is a two-seater, having its V shape interplane struts sloping outward, toward the top; Type 17, a single-seater with a circular front section, some of this type having a spinner over the propeller boss. The ailerons are mounted on steel tubes and are operated from the control lever by means of cranks. The top of the rear portion of the body is covered with curved veneer. The tail skid is supported on a structure of veneer. The machine gun is mounted over the center of the body, directly in front of the pilot. On the right there is a drum, on which the belt with the loaded cartridges is wound.

The dimensions of Type 11 Single-Seater are given as follows:

Span, upper plane	24'-8"
Span, lower plane	14'-3"
Overall length	18'-10"
Height	8'-1"
Power plant	80 H.P. Le Rhone
Propeller, diameter	8'-2"
Gross weight, empty	760 lbs.
Pilot	176 lbs.
Gasolene (20½ gallons)	121 lbs.
Machine gun and ammunition	110 lbs.
Total weight loaded	1210 lbs.

The climb in 4 min. is 3300 ft.; 7 min., 6600 ft.; 11 min., 9900 ft.; 16 min., 13,000 ft.

NIGHT ATTACK

See also

ILLUMINATION—FOR NIGHT ATTACKS

[Remarks on Night Firing with Machine Guns. *Krigs. Vetenskap. Akad.* (Swedish), Sept, '16. 1700 words, 1 table and 1 illustration.]

In defense against night attack, flanking fire by machine guns is of effect equal to, if not greater than, that of simple frontal fire. It is a mistake to believe that machine gun fire is ineffective if the gun has not been sighted at its objective during daylight, nor is its use entirely dependent upon the use of artificial lighting of the field of fire by such means as slow burning magnesium stars, parachute lights or straw piles soaked with petroleum, etc.

By means of the table it can be seen that if the field of fire is artificially lighted for any length of time, the firing proceeds as in daylight; if lighted for only short periods, the firing is spasmodic. At the first instant of light, direct and steady fire to the front is maintained and then quickly changed to a mowing effect, and finally a raking fire is delivered.

In case the objective cannot be illuminated, recourse is had to the following method. Machine guns are placed at the points of probable advance of the enemy, such as bridges, defiles, etc. A board, upon which is fastened a coarse heavy sheet of paper, is rigidly attached to the carriage of the guns by an arm that holds it out to the side and front. To the barrel of the gun is likewise fastened a pointer suitably bent and of such length as to strike the paper. During daylight, the gun is sighted at points of advantage, and these points are plotted on the paper. Hence the gun can be aimed by means of the auxiliary pointer

NIEUPORT AIRPLANE—Continued

and the plotted points on the paper; the only light necessary is that of a flash-light to illuminate the paper. The kind of fire to be used if attacks were made in day time is noted, and the gun set accordingly. Also a system of signals is arranged with patrols to indicate the particular approach of enemy. Each gun should not have a front assigned of more than 100 meters.

(The illustration shows a Vickers-Maxium gun with the attachment above described The tables show kinds of targets, range, kinds of fire and effect of fire in hits and percentages for the different methods of sighting for night firing.)

NIGHT OPERATIONS

See also

AERONAUTICS—NIGHT OPERATIONS

[Night Exercises. By X. *Memorial de Caballería*, Aug, '17. 2000 words. Illustrated.]

This article describes a series of exercises conducted by the Fourth Section (Cavalry) of the Central School of Fire during the preparatory period of the course for officers. The fire of machine guns and carbines was utilized alone and in combination with the illumination of the terrain furnished by a field searchlight unit.

The 1915 edition of Tactical Regulations for Infantry prohibit the use of fire by troops making a night assault. It is expressly stated that *guns will not be loaded.*

The same regulations prescribe that troops acting on the defensive, when assaulted at night, will use a vigorous fire but at short distances only—that is, when the enemy is actually at the position.

The use of hand grenades on such occasions is also prescribed and a counterassault with the bayonet is enjoined.

It is clear that these regulations do not take into consideration the use by both sides of elements of illumination.

The present war has caused a revision of many technical principles until now admitted and circulated as truths. The motive of the Fourth Section of the School of Fire in planning the night movements described, was to subject the before-mentioned principles to a rigorous and methodical experiment, with a view to determining the practicability of night firing at other than the closest ranges. The exercises comprise two large groups:

1. Exercises in combination with a field illuminating unit.
2. Exercises without the illuminating unit.

The searchlights used were one of 90 cm., two of 60 cm., and four of 25 cm., of the electrical types and one 40 cm. searchlight of the oxyacetylene type.

According to the most modern authorities, the principles that govern the use of military searchlights are as follows:

(a) Searchlights of 90 cm. caliber and larger are used as those of position; those of 60 cm.—of medium power—being mobile and light, are for field operations; and those from 40 to 25 cm., the lightest and easiest to transport, are used to illuminate the immediate foreground of trenches.

(b) Field searchlights and those of position are under the orders of zone or sector commanders. The lights of smaller caliber are under the orders of local commanders.

(c) Searchlights are given the following missions:

(1) To discover the hostile artillery, machine guns, riflemen and aircraft, so that fire can be brought to bear upon these targets.

(2) To disclose hostile movements at night by means of a methodical exploration of the terrain.

(3) To blind the enemy, thereby contributing to his demoralization and impairing the efficacy of his fire.

(4) To combat enemy searchlights, flanking his troops with beams to the right and left.

(5) To direct the march of a column, of an avion, etc.

(6) To illuminate the ground for night work.

(7) For signalling.

(8) For artifices and deceptions.

(d) Searchlights are used collectively. The use of one searchlight alone is exceptional. They should at least be used in pairs.

(e) They do not throw a constant light save in exceptional cases, but are used alternately.

(f) Their security and the continuity of their action is maintained by locating them advantageously—protected from the fire of rifles and machine guns, and if possible several kilometers in rear of the advanced positions.

(Continued.)

NISSEN HUTS

[The Barrel-Like Home of Tommy Atkins. *Scientific American*, Apr 14, '17. 110 words. Illustrated.]

The British troops behind the lines are housed in the Nissen huts, named after the British army officer who invented them. They are galvanized iron structures. The roof members are curved plates. All parts are easily carried thru the war zone and assembled by the soldiers. The huts are weathertight, have windows and doors, and are heated by stoves.

NITRO-STARCH

See also

EXPLOSIVES

NIVELLE, General

[Heroes of the Tragedy. The Defender of Verdun. By Gómez Carrilo. Reprint from *La Nación, Revista Militar*, Aug, '16. 2800 words.]

(A character sketch of General Nivelle.)

Tall, robust, with bulldog jaw and a glacial look in his clear eye, General Nivelle seems at first sight a typical example of the race of conquering Englishmen that Kipling depicts in his novels. The officers of Bourges still recall Nivelle when he was at the Saumur School, showing his wolfish teeth in a happy smile while performing the most dangerous feats with perfect ease.

"This man," exclaimed one day his brigade commander, "may break his bones in a steeplechase, he will certainly never break his head at the War College." No one seemed less fitted for the difficult and intricate duties of the general staff, none seemed less scientific, less "modern," than he and no one seemed to have more contempt for books. And yet one day he left his regiment, his horse and his sports to shut himself up in an academy to work at the innumerable courses of study which conduce to the art of military command.

Once possessed of his "brevet" he entered that coterie of officers who "singe their eyelashes" in the technical offices of the ministry. In reality, however, his realm was not that of books and papers. He was always insisting on being sent to the colonies, believing that in this essentially pacific century there would be no opportunity for active service in his own land. In China in 1901, and later in Africa, it was his luck to smell powder in actual warfare.

In 1914, when the war began, he was in command of an artillery regiment at Besançon. Each man viewed the war according to his character. The rough Nivelle, for his part, felt the superb splendor of the tragedy. On the night preceding the receipt of the orders to march, an old major, imbued with the sentiments of Tolstoy, undertook to move him by describing the horrors of the torrent about to sweep over Europe. The Centaur of Bourges pronounced in a few words his philosophy of life and of death: "What is man? Nothing. What is existence? Nothing. Better to live one day as a lion than a hundred years as a rat."

From the first moment of action he was as a man transformed. Gone were the cold calmness, the frigidity of his look and in their place came Latin ardor and gaiety. No other commander so embodies the traditional virtues of the French people. Suave and kindly with his men, his example leads them to acts of the most exalted heroism. The world now knows that during the first fifteen days of his command at Verdun, he recovered all the ground lost by his predecessor.

The curious thing about this officer is that but a few years ago he thought, as did also General Pétain, of retiring to civil life because promotion seemed hopeless. General Joffre, however, appreciated the greatness of his character. His first noteworthy act in war is a fine example of military decision. On Sept 16, 1914, in the sector of the Yser a German advance forced back the French VII corps, obliging it to retire to the left bank of the river. The only commander who did not conform to the general withdrawal was the Commander of the 5th Artillery Regiment. With extraordinary audacity, this colonel rapidly advanced his batteries to cover the withdrawal, and opened such a tempest of fire upon the German columns that they were halted and thrown back, thus gaining time for the French to reorganize and to put in motion a victorious counter-attack. In October, 1914, Joffre gave him an infantry brigade which he commanded on the Aisne front, and in January, 1915, saved the city of Soissons which the Germans were then trying hard to capture. An officer in a private letter wrote that there was no spectacle more reassuring than that afforded by Nivelle when under fire. One morning in a wood during a pause in the advance, noticing that the rain of projectiles caused his staff officers to duck their heads somewhat nervously, he took out his pipe, lighted it, and after a few puffs said: "I should like to know a logarithmic table that would determine the distances between projectiles and one's destiny. Each of us is but a destiny with feet and hands. When our hour arrives to go to Hell no prudence on our part will be of any use, nor would any imprudence be a real risk unless one's hour had struck." Hearing these words the officers turned to the front and without faltering continued the march which led to a victory. To men like Nivelle, to fight is to exercise a natural function instinctively.

NON-COMMISSIONED OFFICERS

See also

PROMOTION—NON-COMMISSIONED OFFICERS

OBSERVATION CARS (For Dirigibles)

See

DIRIGIBLES—SUSPENDED OBSERVATION CARS

OBSTACLES

See also

ENTRENCHMENTS

OFFICERS

See also

PROMOTION—OFFICERS
UNITED STATES—ARMY—OFFICERS

[The Modern Officer: Major Leopoldo Jorge da Silva. By "E. P." *Revista de Artilharia,* Dec-Jan, 1916-17. 2500 words.]

(An appreciation of the late Maj. da Silva, with an introduction on the qualities of the modern officer and his responsibilities.)

The modern army is no longer composed of a mass of untrained men led by a number of other men who have decorated their uniforms with gold lace, as is sometimes erroneously supposed by the uninitiated. In the twentieth century an army is not the multitude of mercenaries of other days led by valiant and audacious but ignorant adventurers. Armies of to-day are entire nations in arms, lawyers serving in the ranks alongside the worker from the factory, the college graduate by the farm laborer.

What is the force which binds together these thousands of men of such different qualities and interests in life to make up an army fighting together for a common end? It is discipline, but intelligent discipline, which, while absolute, is based not on fear of punishment, but on the firm conviction that by this means alone can we co-ordinate the forces of our men so as to have a chance of success. Above all else there must be absolute confidence and faith in the officers, not only in those in immediate command but also in the higher officers and especially in the "chief," who must be worthy of this name in all respects, a man

OFFICERS—Continued

whom none hesitate to follow over the road to glory or the road to death.

It is not only in the army that discipline is required, but in the family, the small community and in the nation. All must possess the courage to meet their responsibilities and duties to the same extent as the captain of the sinking ship; he must be the last to seek personal safety.

The officer of to-day in order to meet his enormous responsibilities and to discharge his onerous and multifarious duties requires a vast amount of energy, intelligence, tact, varied knowledge, and, above all, an unassailable honesty in all things. To inspire confidence and inculcate the kind of discipline that is needed, the officer must be truly the superior of his men in all respects, and this superiority must be instantly apparent to every man who sees him.

[The Law. By Major Leunam. *Rev. del Circulo Militar,* Feb, '17. 1000 words.]

The law regulating selection and promotion of officers has been suspended; future action is awaited with great anxiety as upon this law depends the quality of our officers and the military power of the nation.

Unfortunately this subject is too often considered on the one side from a commercial point of view and on the other from a selfish desire to secure personal advantage.

To be just and effective the law should establish an exact equivalent between rights and duties. The military life compels the surrender of many rights and privileges and the officer must devote himself, body and soul, to his profession. The institution which demands such sacrifies should assure a definite future.

Promotion and retirement are not gifts but acquired rights. They represent magnitudes of effort and capacity which are capable of being weighed and determined.

Feeling assured of his future the officer will exercise his energies without stint within the sphere of his activities and will not seek advancement thru improper influences nor depend upon the caprice of fortune.

Promotion should be accelerated. This in order that those who fall by the wayside may still be able to face the struggle of life with some chance of success and that those who succeed may attain the higher grades while in the fulness of their powers.

—Instruction and Training of

See also

CAVALRY—ORGANIZATION (Article: "Cavalry Organization")

[Marshal Joffre's Statement. *Army & Navy Jour.,* May 5, '17. 700 words.]

In answer to a question of American correspondents in Washington as to the length of training period necessary to form a new army, Marshal Joffre replied that "no definite answer was possible. The example of England may throw some light on the probable time it would take. Staff officers necessarily are slowly prepared, but subordinate officers can be trained with considerable speed when such fine material as the English is concerned. The American army would probably develop even faster, as it would profit by the experiences of the British and French armies." He also said that there was no reason to doubt the capacity of the officers of the American army to fully train their men in spite of their distance from the field of action.

[The Reserve Officers' Training Corps in the Land Grant Colleges. By Capt. R. W. Welshimer, C.A.C. *Journal U. S. Art.,* May-June, '17. 16,000 words.]

(This article, because of its detail, is not susceptible of easy abstraction. It is a valuable contribution to the subject it investigates, and may be safely recommended to the attention of those interested in it. Nothing more is undertaken here than an indication of its scope.

The Reserve Officers' Corps in our colleges must be regarded as the logical development of the Morrill Act of 1862. A history of this act is given, with comments upon the manner in which it was applied by its beneficiaries. As an example, the University of Illinois is cited, a university that recognized the full value of the act, and was in sympathy with its purposes. The National Defense Act of June 3, 1916, is next taken up, and is followed by a discussion of the Reserve Officers' Training Corps established by its provisions. Defects are noted, and a "model system for the proper development of Reserve Officers' Training Corps" presented for consideration. A schedule of courses in the Department of Military Science is given. The schedule sets out periods and hours for instruction, describes the work that should be undertaken and recommends textbooks. No important detail is overlooked.

The author expresses the belief that a liberal interpretation of the law will convert what is now a makeshift into a system of adequate military training.)

["Technical Studies in the Army." By Lt.-Col. F. *Memorial del Ejercito de Chile,* July, '17. 3400 words.]

In the preparation and direction of modern war a merely tactical instruction of officers is insufficient. The methods of destruction, of protection and of locomotion now in use necessitate a corps of officers whose training has been based upon scientific lines. There are in the army a series of grave problems of technical aspect that cannot be solved without direct concourse of the necessary technical personnel. The services of special groups of officers in the different technical branches of the army enable the state to economize greatly in the manufacture of all that the army needs for training in peace and for combat in war.

A course of armament is advocated for the purpose of completing the special instruction of officers of artillery and engineers; and to enable officers of the other arms to receive the necessary instruction in the services of armament, manufacture of material of war, services at the school of fire and as technical representatives of the army abroad. The plan is for the

school advocated to function as an annex to the War College; the course to last three years. The military year will be divided into two periods.

A. Period of theoretical instruction, to last nine and one-half months.

B. Period of service with troops, to last two months.

(The remaining half month is for leave of absence for the student-officers.)

The weekly work thruout the three years of the course will be as follows:

1st year:

Mathematics	5 hours
Mechanics	3 "
Physics	5 "
Experimental Inorganic Chemistry	2 "
Study of Arms	6 "
Ballistics	2 "
Tactics	2 "
Aviation	1 "
German	6 "
French	3 "

2nd year:

Mathematics	2 hours
Descriptive Geometry	3 "
Mechanics	2 "
Electricity	2 "
Experimental Organic Chemistry	2 "
Analytical Chemistry	3 "
General Metallurgy	2 "
Instruction of Arms	6 "
Ballistics	3 "
Machinery	1 "
Tactics	2 "
Aeronautics	1 "
German	4 "
French	2 "

3d year:

Mathematics	2 hours
Heat	2 "
Chemistry of Explosives	10 "
Technical Forestry	6 "
Construction of Arms	10 "
Ballistics	2 "
German	4 "
French	2 "

French and German are necessary to enable the officer to read and translate technical military literature. The development of this program is the least that can be demanded in this day and time of officers who aspire to the knowledge that is absolutely necessary to enable them to organize a modern army.

Students of tactics and of organization now need the assistance of technical knowledge to the end that they may take advantage of all the assistance that science gives to military service.

[How to Teach an Army. *Army & Navy Jour.*, Nov 10, '17. 800 words.]

Lieut.-Col. Paul Azan of the French Army, in a lecture in Boston explained his ideas as to how our new armies should be trained as follows:

In these days army instruction is never completed and is never definitive. The problem of teaching is permanently before the high command, whether in the instruction of the men in the use of new engines of warfare, the teaching of recruits, of reorganized units, or in the spread of new applications of principle.

To furnish competent instructors, there must be schools for officers of all arms of the service, and at these schools it is necessary to congregate the officers who are found most qualified to instruct. These principles have at last triumphed in France, not without difficulty or without serious losses incurred before their recognition.

The instruction given at these schools must be thoro and without haste. The half-instructed, the incapable, the undisciplined, the conceited, cannot carry the true principles of modern warfare abroad.

The conclusion drawn is: The way to begin instruction is to carry it out from the top down, and not from the bottom up—intelligence must move from the intelligent to the ignorant; from ignorance only ignorance proceeds.

Uruguay

[Recruitment of Officers in Uruguay. By Lt.-Col. D. Jan Garcia y Gomez Caminero. *La Guerra y su Preparación*, Apr, '17. 1000 words.]

Officers of the Uruguayan army are normally commissioned after pursuing the course in the Military School. The law provides that one-fourth of the vacancies in the grade of second lieutenant may be given to sergeants of four years service, but these must first pass an examination in the Military School. The Government appoints officers of the National Guard from members thereof either of the first class (Mobile Guard, 17 to 30 years of age) or of the second class (Departmental Guard, 30 to 45 years). These latter appointments are communicated only to the appointees, who have neither commissions, titles, nor uniforms. For many years the Government has made no such appointments.

Those who are to become officers of the three arms of the army are educated together in the same Military School. This institution, known at first as the General Military Academy, was founded by General Mella on the then Spanish model. Later the institution was united with the Naval College under the name of Military and Naval School. In 1916 the two institutions were again separated. The course was at first on the Spanish model; later non-military subjects were also studied. The course was five years. The length of the course and the diversity of studies made this system unsatisfactory. Last year the course was reduced to three years, only the practical courses necessary for the education of officers being retained. The commission which recommended the change also recommended the establishment of post-graduate schools, and the sending of officers of all arms, but especially of engineers and of the General Staff, to foreign countries to study.

OFFICERS—Continued

In order to prevent the students from shirking during the course, and relying on a final examination, each year is divided into two semesters, with an examination at the close of each.

The entrance requirements are: to be a citizen, to be between 15 and 20 years of age, to present certificates of good character and vaccination, and to have a minimum height of 1.5 meters. Soldiers may enter up to 21 years of age. The professors are appointed by competitive examination, and have salaries analogus to those of professors in civil institutions.

—Promotion of

[Promotion by Seniority. *Army & Navy Jour.*, Apr 21, '17. 600 words.]

A study of history seems to show that a man with the superior military ability of Napoleon, Caesar, Hannibal, Alexander, etc., lives, or at least appears, only once in several hundred years. Every nation therefore must arrange to fight its wars with generals of limited ability. This, to be successful, requires team work. Every officer must respect and be loyal to his immediate superior and obey his orders, not only to the letter, but in their spirit. This result, the German authorities think, can be obtained only by seniority promotion above the rank of major without exception, and below the rank of major with occasional but rare exceptions. Promotion is more rapid by seniority than by selection if the incompetent are promptly weeded out, and in this way the men of ability come to the top without causing resentment or injuring the self-respect of their brother officers.

—Qualities of

[Military Morale. Reprint from *Boletín del Centro Naval. Revista Militar*, Nov, '16. 2800 words.]

(A lecture on Patriotism, Honor, Duty, Responsibility and Discipline, dedicated to the Midshipmen of the Fleet.)

In exchange for the security which the nation offers to all who enjoy its protection, it demands the military concourse of all its sons for one or two years without exception of class or hierarchy.

Obligatory military service is a tribute paid to the nation, in peace, in the preparation for war; in war, in the unchangeable money of abnegation, fatigues, privations and sacrifices of blood.

The law of conscription is the same for all. The physically unfit and the only sons of widows only are deprived of the happiness of serving. There is one other exception but of a different nature, namely those who for crimes or infamous offenses have become unworthy—for the honor of the soldier must be without stain.

To the corps of officers attaches the responsibility for converting the transitory duty of the conscript into a duty permanent and constant. To dedicate one's self to the military life is to dedicate all the activities of existence to an exceptional career, to renounce individual liberty, private gain, hopes of amassing a fortune; particular interest disappears, the officer lives solely for the general interests of the nation.

The one right that justifies the existence of the officer is his constant preparation for triumph in war. His life must be an example at all times and always. The strength of the officer reposes in nobility, the firmness of his character, his military virtues and his technical knowledge.

Command recompenses or punishes. Responsibility for his acts always accompanies the officer.

The nation is not ungrateful to those sons who devote to its service from youth to the tomb all the energies of heart, brain and being. It preoccupies itself with their well-being and their instruction, and finally it repays their abnegation with special honors, exceptional prerogatives and a pension for debts. A soldier must be free from financial worry, his one problem in this respect must be to avoid spending in one month more than he gains in thirty days.

Promotion is gained not by fortune or by rights of family but by personal merit. The state, for its own proper interests, and society, for sentiments easily understood, surround the officer with an aureole of confidence and respect; for this reason the armed institution should guard jealously the reputation of its members. For an officer his honor is more than his life, the slightest shadow will brand it ineffaceably. Honor is the power of the officer. Without honor it is impossible to live.

The triple rôle of the officer is to command, to instruct, to educate.

An officer is unfit to command unless he knows how to obey. To be able to instruct an officer must know; to know requires intelligence and study. To educate, an officer must have character and abnegation. Of these qualities, the last two are most essential.

It is necessary to learn how to give orders. Frequently orders are badly executed because they are badly given. It must not be forgotten that to give an order is a serious act. The order must be well thought out and clearly given. Once given its exact compliance must be demanded. Unnecessary fatigue is the result of gross neglect of duty.

The officer must guard the health of his men, care for their food and manner of living. If the law gives an officer power to punish the men it also obliges him to care for them as he would for his own sons.

Responsibility is the joy of the military profession; it is the sport of the spirit. Fear of responsibility indicates the worst form of moral decadence in an officer.

Calmness in an officer is a grand quality. It is acquired by the habit of responsibility and the custom of overcoming the unexpected. Fear is a bad counsellor and indecision brings terrible consequences; *orders, counter-orders, disorders!* The prestige of the officer depends upon firmness in orders, in his opinions, and in all his acts.

One may be severe and yet kind; kindness is not familiarity, nor is severity akin to pride or disdain.

It is a grave defect to speak badly of superiors. Subordination must be loyal.

Effort should not be expended in the pretense of superior virtue or knowledge; it should be expended in acquiring it. True merit only is of value.

Discipline must be a matter of conscience, and voluntary. Discipline based upon fear is that of prisons. Conscripts must be shown that discipline is a duty created in the interest of the nation and also of themselves. Discipline and military education form the man and teach him his duties; praise and distinctions stimulate his zeal; admonitions and punishments correct his faults. Prevention is worth more than punishment. Authority should be exercised with kindness and severity; kindness for the good, severity for the bad—and justice for all.

OJOS AZULES, Action at

[The Cavalry Fight at Ojos Azules. By First Lt. S. M. Williams, 11th Cav. *Jour. U. S. Cav. Assn.*, Jan, '17. 1200 words. Sketch map.]

On May 4, 1916, word was received of an engagement in progress between about 200 Villistas and a Carranza force at Cusihuiriachic, a mining town about 15 miles to the south.

At 8:15 p. m. Maj. R. L. Howze, with six troops and the machine gun troop (40 men each) started to the scene.

Arriving about midnight, it was found that both sides had retired after a bloodless battle lasting all day. The Villistas had retired to Ojos Azules ranch, location unknown. There was a delay until 3 a. m. until guides were secured, the Carranza force declining to furnish any. At 3 a. m. the march was resumed, marching most of the time at a trot. The twenty miles to Ojos Azules ranch were covered by 6 a. m. The plan of attack was for the leading troop to push ahead and alternate troops thereafter to push by either flank to cut off the retreat. The Villistas were surprised and fled, offering some resistance. The action was of small importance, but illustrated the mobility of cavalry, the rapid deployment from column, and the effectiveness of the automatic pistol for mounted work. 44 Villistas were killed. The United States trooped suffered no casualties.

OPTICAL INSTRUMENTS

—Use of in War

[A Study of the Dependence of Successful Warfare upon Optical Instruments. By Charles Nordmann. *Revue des Deux Mondes*, Mar 1, '17. 4500 words.]

From every point of view, war is a problem of finding the target, in the widest meaning of the expression.

To see, to discover what the enemy is doing, and where he is, has always been three-fourths of the art of defeating him. The more we understand the essential aspects of combat, the more we realize the enormous advantage, in war, of seeing without being seen.

The necessity of using cover, and of seeing without being seen has compelled the use of all sorts of artifices by means of which the eye has been able to extend its powers of vision, and to obtain indirect vision. The science of optics has therefore become one of the most useful auxiliaries of warfare.

To see at what disadvantage a belligerent deprived of optical instruments would find himself before another provided with them, we may turn to the tragic case of Rumania. The Rumanian Army was equipped with Krupp artillery. For nearly thirty years Rumania had had a treaty of alliance with Germany. With diabolical foresight, the Germans has systematically tampered with one small optical detail of the guns supplied to Rumania. All the air-bubble sight levels had by the manufacturer been filled with ordinary water instead of with the necessary saline solution that would prevent freezing in cold weather.

If Rumania should go to war in alliance with Germany the latter naturally intended to rectify this defect; on the other hand, should Rumania take the field against Germany she would have her guns compromised. This is what actually happened, and Rumania found when she took her guns into the mountains, the cold froze the water in the sight levels, and thus prevented good results in firing. It is astonishing that such perfidy could be practiced, and also astonishing that Rumania's officers did not discover it.

Not only would a belligerent deprived of optical instruments be unable to sight his guns accurately, but he could not measure distances in order to determine ranges, which is such a necessary element of firing; moreover he could not observe the effects of his fire.

Infantry would suffer no less. Being obliged to use cover, it would, without instruments of indirect vision, be entirely blind, subject to surprises, and unable to operate intelligently. Blinded by the searchlights of the adversary, with none of its own, it would be more helpless at night than in the daytime.

Similarly, the aerial service, the navy, and all other branches of the service would be practically helpless.

We must confess that the German infantry, at the beginning of the war, was greatly superior to ours in its equipment of optical instruments. Most of its commissioned and non-commissioned personnel were provided with excellent prismatic field glasses.

Many of their sharpshooters were provided with telescopic sights. This fact, together with the unusual visibility of our braid, etc., accounted for our heavy losses in officers.

Good glasses must be of the prismatic type. These have a remarkable magnifying power for their small dimensions, and an extended field of view; but their principal value is found in the increased relief they furnish. The sensation of relief is due to the superposition of the different images produced by each eye. It is therefore evident that the more different these images are, the more marked will be the relief. Thanks to the prisms, the objectives of the lenses can be much more widely separated (usually two times more) than are the eye pieces of the field glasses. The effect is the same, thanks to the concentration of the light rays made by the prisms, as if one were observing with eyes separated twice as much as they really are.

At the beginning of the trench warfare, the Germans had certain riflemen, designated as "officer shooters," provided with telescopic sights. We know only too

OPTICAL INSTRUMENTS—Continued

well what those machines, permanently trained upon our loopholes, did to those who remained long in front of them.

There are various types of periscopes now in use in the trenches.

With the artillery the most important instrument is the range finder. Those now in use do not err more than about 5 per cent in accuracy.

The use of searchlights has become of the greatest military importance. They are used in connection with rockets.

Searchlights not only serve to reveal the enemy if he approaches at night to the attack, but blind him, and may for that reason be classified as offensive as well as defensive instruments.

Not only is one able to sweep constantly all the immediate approaches of the trenches with light, but, thanks to its effectiveness, one can surprise reliefs, clandestine assemblies, supply trains moving behind the lines, etc., and can therefore break up and harass such movements with artillery fire.

Another important use that is made of searchlights is that of signalling. When provided with the proper system of shutters, the searchlights can be used with the Morse code of signalling. They have proven to be of great value for this purpose. Of course, searchlights play a vital part also in naval operations.

Finally, aerial warfare in all its forms has opened a vast new domain for the employment of searchlights. Without them, defense against nocturnal aerial bombardment would be impossible. The use of them has enabled England and France to cope with raiding Zeppelins.

In this connection, it has often been proposed to place the searchlight on the guns themselves in an effort to solve the problem of nocturnal firing. However, this measure would be inefficient and harmful; inefficient, because directing the line of sight at the target does not mean hitting it, and the sight elevation must vary with the distance, and the barrel itself be pointed off, not at the target; harmful, because when placed directly behind a searchlight, one sees the objects illuminated by it much less clearly than when placed a certain distance to one side.

The searchlight of to-day is a highly developed and efficient instrument. The mirrors now used are simple parabolic reflectors. Military authorities prefer metal mirrors to glass, because they can be penetrated by bullets without being shattered. The reflecting surface is silvered; or better, gold washed (because gold does not tarnish as does silver). The electric arc light is used, and provides a bright light. In the field searchlights used along the front, electric energy is provided by the motor of the *auto-searchlight,* itself, i. e., by the same motor that transports these most valuable instruments. The American *Sperry* searchlights have reflectors about one meter in diameter, and provide good illumination of objects many kilometers away.

The periscopes used on submarines are similar in principle to those used in the trenches, but more complicated, and more highly developed.

Photography also now plays a most important part in warfare. Reconnoitering airplanes take pictures which are used not only in directing artillery fire, but in preparing plans for attack.

ORDNANCE

See also

AMMUNITION

MOTOR TRANSPORT—REPAIRS AND RENEWALS

—Bullet Proof Materials

See also

ARMOR—PERSONAL

—Metallurgy

See also

STEEL—USE OF IN THE MANUFACTURE OF ARMAMENT

—Proving Grounds

[The Proof and Experimental Department in India. By Major C. J. D. Freeth, R. A. *Jour. Royal Artillery,* July, '16. 1800 words.]

In 1893, some 10-inch common shell were sent from India to England for proof, which drew the attention of the government of India to the non-existence of a proof department in India.

After investigation and experiment a site near Balasore was selected, and occupied in October, 1896. Balasore is situated near the coast about 140 miles south of Calcutta. It is headquarters of a civil district and about 8 miles inland from Chandipore where the proof range is located. When first established the means of communication employed was by launch and barge thru coast canal to Calcutta. The completion of the coast railway from Calcutta to Madras simplified the transportation problem.

Chandipore is practically uninhabited except by the proof department and public works employees. The European staff is quartered at Balasore.

The work of the proof department now consists of the proof of all artillery ammunition and cordite, fuses, primers, guns, the preparation of range tables, and other experimental work. Every description of gun, except the 7.5-inch B. L., in the Indian equipment is found in the equipment of the main range, which is over water and pegged out to 8000 yards. The proof of cordite and the guns is carried out on the velocity range. There also is a short range of 2000 yards which is used for shrapnel effect proof, and is provided with facilities for taking muzzle and remaining velocities.

The proof of current small arms ammunition now is carried out at the factories at Dum Dum and Kirkee, tho for a time part of this work was done at the small arms range at Balia, about 2 miles west of Balasore in the opposite direction from Chandipore.

OUTPOSTS

See also

PATROLS

[Extracts from German Tactics of Frederick Emmanuel Published in the Summer of 1914. By Kellega. *Voenny Sbornik,* June, '16. 3500 words.]

(This article is a translation from the German of Paragraphs 286 to 317 of the work cited, without comments. The part selected for translation treats of outposts and contains all the usual requirements known to the American army. The principal change from the practice in our service is in the form of the order issued which is not as stereotyped as is usual with us. A sample order, in outline, follows as an illustration:

13th Inf. Division. 1-9-14, 12 noon.

1. Major B. with 1/1 and ½ 4th Sqad. 1st Dragoons establishes the outposts.
2. (Information of the enemy.)
3. The main body of the advance guard will be at ——. The main body of the column will be at ——.
4. The 1st Dragroons (1, 2, 3, Sqad.) takes quarters at ——.
5. Connection will be maintained with ——.
6. In case of attack by the enemy, the main body assembles at——.
7. The reserve of the outpost will be at ——.
8. (Directions as to the heavy baggage.)
9. (Directions as to supplies.)
10. Messages to ——.

(Sig.) A,
Maj.Gen.

The number of paragraphs in the order is unlimited. Altho the arrangement of subjects is similar to that in use in our service, a separate paragraph is given to each subject, or part of a subject. This is particularly true as to the trains, each train being separately treated in its own paragraph. The requirements as to quarters are naturally different from those in use in our service where the quartering of troops on the inhabitants is practically unknown, instead of being the common practice as in Europe.

OVENS

See

KITCHENS, MILITARY—FIELD OVENS

OXYGEN

See also

MARSITE

PACIFISM

See

PEACE PROPAGANDA

PACK SADDLE

See

SADDLES—PACK

PANAMA CANAL

—Defense of

[The Panama Canal: The Problem of Its Defence in a Future War. By Capt. C. S. Goldingham, R.M.L.I. *United Service Magazine,* June, '17. 3600 words, with map.]

The value of the Panama Canal to the United States is threefold, commercial, military, and sentimental. From a commercial standpoint its value is secondary only to that of the Suez Canal to the British Empire. It provides the shortest route from the Atlantic coast of North America to the Pacific coast of South America. It is unnecessary to call to mind the economic advantages rising from this fact, but it also brings its disadvantages. The freight per ton per mile on sea-borne cargoes is so low that there will always be a tendency to import rather to produce raw materials, given that the cost in each case is equal. Here lies the source of national weakness in the event of war where essential commodities are concerned. It is in the tonnage dues paid to the United States by vessels making use of the canal that its commercial value lies, though as yet this value is only potential. Even during the year 1916 the canal, assisted by its railroad, failed but by little to pay for its cost of maintenance and running expenses, despite the huge landslide which put it out of action for several months and that a very considerable portion of British shipping was earmarked entirely for work in Europe.

The employment of the canal as a means of communication between the Atlantic and Pacific coasts of the United States is of value chiefly from a military point of view. In the absence of a Pacific fleet, its importance is vital to the defence of the country. Its control by the United States enables rapid concentration of their fleet to be made in either ocean. Free and unrestricted use of it can only be secured by rendering it safe against attack, thus giving the United States the possession of interior lines of movement for their fleet. From the sentimental point of view the loss of the canal would be a deadly blow to their dignity, for the construction of the canal, when France had already failed, is one of the greatest triumphs of modern days and should stand as a record of American enterprise and perseverance.

The possibility of successfully defending it in case of war is extremely doubtful. The conditions which would render its defence a matter of extreme difficulty are unlikely to rise at present, but that they may arise when conflicting interests in the Pacific begin once more to make themselves felt is a contingency for which the United States seem to have failed to make sufficient preparation. The most vulnerable points of the Canal are at Gatun, Pedro Miguel, and Miraflores, where there are locks. In addition to this, a very considerable portion of the Canal consists of a big lake, formed by damming the Chagres River to a height of 82 to 87 feet above the sea-level; this lake requires over two years to fill and the pressure of the water is such that slight damage to the dams at Gatun or Pedro Miguel from shell fire would result in a rush of a huge volume of water which would overwhelm the entire canal. The defences consist of a system of forts and batteries at either entrance, with submarines stationed or based there, and defensive lines constructed in the five-mile strip of territory on either side of its entire length, under control of the United States. In the event of an enemy landing this strip of five miles forms inadequate protection against bombardment. Sea power alone can protect sea-routes. In certain eventualities the return from the Pacific via the Panama Canal of a fleet dispatched thither would be rendered so hazardous that it would be out of the ques-

PANAMA CANAL—Continued

tion for it to quit the Atlantic if there were any possibility of its being required again at short notice. This eventuality might arise if the United States were at war with a Pacific Power, or with a European Power whose objective was the Panama Canal. It is an obvious fact that, depending as it does on sea communication with the United States, which has not the command of the sea, the Panama Canal becomes an isolated defensive position in war time, and must succumb before a resolute attack. A successful offensive naval operation is out of the question. The narrow strip of Isthmus territory under United States control gives very little to veer and haul on, and provides scanty protection to the vital parts of the Canal when the range of modern guns is taken into consideration. Cut off as it would be from all supplies, once communication by sea had been rendered impossible, it would fall into the hands of the enemy when they had succeeded in isolating it. It also lacks any sort of railway communication with its base.

The correct method of defence consists in removing the scene of operations from the vicinity of the Isthmus by attacking the enemy's base. If the attack can be sustained, it fulfills the purpose of protecting the waterway, whether it captures the base or not. The point selected to be attacked must be of sufficient importance to obviate any possibility of the enemy abandoning its determined defence for a counter-offensive against the canal. If the United States were at war with two or more Powers at the same time, it is imperative that the Isthmus waterway be rendered capable of sustaining itself against attack, and for this purpose the provision is necessary of some other form of communication than by water, the construction of a line of railway to the base—the United States. So long as the railway remained intact it would at least be possible to keep the defences of the canal supplied, and it should be practicable to rush thither a sufficient force to repel any attack by land. A line of railway is less vulnerable to bombardment than the power-houses, locks, and gates of the canal; the destruction of any part by shell-fire does not necessarily render the whole line useless. Provided the enemy does not actually gain possession of any point of the line the latter can still be used even when damaged. If the United States were pitted against one or more of the Great Powers, it seems probable that the Central American States would remain neutral, in which case the landing would have to take place either in Mexico or on the United States coast. A United States-Panama railway would be a Government undertaking, and in the present condition of Mexico the portion passing through that country would require the services of a considerable number of troops to secure it. Nevertheless from a commercial point of view it would be a profitable adventure. The possibility of a hostile Mexico raises the question whether a continuous line of rail from the Isthmus to the United States is required, or whether it would suffice to carry it to some point in the Gulf of Mexico, where communication could be effected by sea for the remainder of the distance. In the event of war the United States could, by means of submarines and destroyers, transform the Gulf into an American lake. The key to the Gulf is Cuba and the entrances are two, the Strait of Yucatan and the passage between Florida and Cuba, both a hundred miles across. It should be possible, by netting and other means, to prevent the entry of hostile submarines into the Gulf. However, it is not so much a question of submarines as of a fleet, seeking to gain control of the Caribbean and Gulf waters. Submarines alone could not prevent the transport of troops and supplies from Galveston or New Orleans to the point of termination of the railway, probably Vera Cruz or Campeche. The sounder course would seem to lie in the adoption of the continuous line of rail from the canal to the United States, thus leaving the fleet unhampered.

PAPER

—Use of for Clothing

[Paper for Military Purposes as a Substitute for Textile Fabrics. *Svensk Intendentur Tidskrift*, '17, No. 2. 1800 words.]

The property that paper possesses of being a poor heat conductor is well known, and as it is easily manipulated it can readily be used in place of the more costly materials which depend on foreign textile fabrics. The war has taught the Central Powers to make use of paper for many things and their experience in this connection ought to be of use to us.

Paper, or more correctly cellulose, is used in two ways: as paper yarn to be used in the ordinary textile way and as ordinary paper in its various forms, thick or thin, hard or soft, smooth or crêpe.

The idea of making use of paper as a raw material in the textile industries is not new. The Chinese and Japanese have for ages made use of paper in the manufacture of rope and twine for tying up bundles and bales as well as yarn for weaving cloth. In the United States, many experiments have been made in this line, but owing to the plentiful supply of cotton in that country, they have not led to any notable results there, but have been continued with more perseverance in England and Germany. In the latter country the first practical useable machines for this new industry were made, which have been followed by others, mostly American. As the manufacture has progressed, different countries have specialized on different articles made of paper. In Germany the specialty has been bags and packing materials and now during the war, when jute is not obtainable, they are making paper rope and yarn.

In the manufacture of paper-yarn use is made of paper cut in narrow strips, varying from ⅛ to 4 or 5 inches in width. In the European factories they use as a rule the best Swedish handmade paper whose firmness is equal to other textile fabrics. In the American factories use is generally made of cheaper paper.

An Austrian officer has lately invented a method by

means of which it is possible to spin the paper strips together with flax, hemp, jute, etc., and this yarn resembles jute yarn and possesses great firmness.

The success and value of the paper yarn in the market depends under *normal* conditions not so much on its use as a substitute for jute, cotton or other textile fabrics, but rather on its employment where the use of other textile wares is for some reason or other not desirable or suitable. Thus it is claimed that cloth made of paper yarn is more suitable as wrapping for bales of cotton than jute, since it is, curiously enough, less liable to catch fire and also since the cotton does not stick to it and in this way loss of material is avoided. In Germany and Austro-Hungary paper of various kinds has come into extensive use for military purposes not only for clothing but in the hospitals and also in the construction of temporary barracks for prisoners and the wounded. Of the various kinds of paper that have been made use of, the so-called natron-cellulose paper made of the finest cellulose fibers from wood is the most suitable; it is divided into three kinds, namely, firm and tough wrapping paper; thin, soft, porous silk paper which is free from acid and chlorine; and warm, thick and strong pasteboard. The first of these kinds of paper is suitable, not only as wrapping paper, but also as foot wraps for the soldiers. These are said to wear well and form a good protection against both cold and wet. They are used extensively in the armies of the Central Powers and form a good substitute for woolen stockings.

The silk paper, especially the crêpe paper, is soft, light and quite tough. It is used as interlining for clothing, for handkerchiefs, napkins, towels and first aid bandages. As a lining for military coats and capes it is especially suitable, since two or three thicknesses of thin paper put between the outer cloth and the lining, make the garment as warm as a thick and heavy fur coat besides being cheaper and lighter, also more sanitary and safe from vermin. In the hospitals use is made of this silk paper for pillow cases and pillow slips. Bedquilts are also made entirely of the natron-cellulose paper and these are found to be very hygienic and warm as well as cheap.

The third kind of natron-cellulose paper is the thick pasteboard that is supplied to the trade in large rolls and is very wide. This has come into extensive use in the construction of temporary barracks and hospitals during the present world-war. It has been found very suitable for the walls of these buildings as there will be but few joints and holes where vermin can hide themselves. Paper vests can be made from the thinner quality of this pasteboard and insoles for shoes of the heavier quality.

PARAGUAY

—History

See also

PARAGUAYAN WAR

SOUTH AMERICAN WARS OF INDEPENDENCE

PARAGUAYAN WAR

[Contribution to the Study of the War with Paraguay. Critique Upon the Higher Command. By Major Diana. *Revista Militar,* Nov, '16. 2500 words.]

PART I

Brigadier General Bartolomé Mitre.—General Mitre, realizing that Argentina was not prepared for war, did everything not incompatible with national dignity to avoid a rupture.

On Feb 5 (1865) dispatches arrived at Buenos Aires from Gen. López asking permission for Paraguayan troops to cross the Territory of Corrientes. Mitre refused to grant this and asked an explanation of the concentration of large bodies of Paraguayan troops on the frontier. López gave no explanation but declared war. At this time the entire Argentine army was engaged in suppressing a rebellion in one of the provinces. It was deficient in numbers, organization and equipment. Active operations could not be started until the rebellion was stamped out and the troops put in condition for campaign. Time was necessary to bring order out of chaos and to improvise an army out of such men and material as could be collected.

The alliance with Brazil brought preponderating contingents from that power, but Gen. Mitre was given supreme command. Jealousy caused such friction between the allies that the conduct of operations was in many ways impeded. Gen. Mitre was compelled to use great tolerance with the Brazilian generals, frequently being reduced to persuasion in order to accomplish his aims.

Gen. Paunero with one division was ordered to the Corrientes to combine with the Corrientes troops under Gen. Urquiza. Paunero's mission was to contain López, who had invaded the territory of Corrientes, until the Argentine army could be concentrated. Due to lack of preparation for war the concentration was proceeding but slowly.

Gen. Mitre expected that Paunero upon uniting with Urquiza would have a force of 16,000 men with which to delay the invaders, but this hope was dispelled when a message came from Urquiza to the effect that his troops had refused to march against the enemy and were withdrawing. Disaster was averted only by the inactivity of López. This General had 28,000 men at Yatay—enough to destroy Paunero's small command—while Estigarribia had 10,000 more available for invasion. It is fortunate for Argentina that López was in command. During the first period of the war he did not know how to handle his splendid army and sacrificed by dividing it into small detachments.

In the meantime the Brazilian fleet neglected to blockade the Paraguay River and remained passively at anchor in Rio de la Plata.

(Continued.)

PATRIOTISM

[The Russian Soldier and His Duty. My L. B. Ebdokimov. *Voenny Sbornik,* June, '16. 1500 words.]

(This is an article in verse on the abstract duty of a patriot soldier in the defense of his country, being in the form of a dialog between soldiers, grandfather, children, etc.)

PATROLS

[Patrolling the Rio Grande. By Frank McCoy. *The Military Historian and Economist,* Jan, '17. 2750 words.]

(The author of this article has had much exerience in affairs along the Mexican Border and describes in interesting detail how it is guarded. The article deals with the Rio Grande, the country thru which it flows, the towns near it and their inhabitants.

It also includes a good description of the system of patrolling now used there by American troops which has proved very efficient.)

—In Trench Warfare

[Letters from the Firing Line. By a British Army Officer. *Forum,* Nov, '16. 7000 words.]

In trench warfare, there are two kinds of patrols,—observation patrols and fighting patrols, such as bombing parties and raiding parties. All patrol work is done at night.

The observation patrols are part of the daily work and they go out every night from every company, often several times. It is their business to find out what is going on and protect the line against surprise. Some companies send out patrols under a n. c. o., but it is better for an officer to go. In addition to general observation for information, patrols are sent out to investigate any suspicious circumstance that may be observed during the day.

Getting out into "no man's land" marks a distinct epoch in a man's training for trench warfare. It is wise to give every man a turn at it. In "no man's land" the main factors are the bullet and the endless mazes of barbed wire. Aside from the rats, it is best to reckon any movement as enemy movement, creeping men who may be stalking you or may not have seen you. The latter is unlikely for eyes and ears are wide open in "no man's land."

Personal inspection should be made to see that patrols carry no papers or anything of value to the enemy. Each man carries a couple of bombs, a club (knobkerry). In leading a patrol, it is essential to keep an eye on the compass and on what lies ahead, and not to become too much occupied with what is close about, even tho the loose strands of wire and "giant gooseberries" (big balls of barbed wire) are very annoying. One need not loaf, but it is fatal to hurry or flurry. If you keep cool, make no sound, and lie flat when the enemy flares are up, there is an excellent chance of returning with a whole skin.

PAY, Army

See also

ADMINISTRATION, MILITARY—ACCOUNTING AND PAY DEPARTMENT

Great Britain

[The Soldier's Pay. *Army & Navy Gazette,* Mar 3, '17. 500 words.]

Altho equality of sacrifice can never be obtained between the fighting man and the home worker, it is believed that the English Government should increase the pay of its soldiers so that the present financial inequality need not be so monstrous.

[Increase of Soldiers' Pay. *Army & Navy Gazette,* Mar 10, '17. 350 words.]

As an argument in favor of increasing the pay of the British soldier it is pointed out that in France the work of the soldier has twice been recognized by increases in his pay.

PEACE PROPAGANDA

See also

EUROPEAN WAR—PEACE NEGOTIATIONS
MILITARISM
TREATIES OF PEACE

[About Pacifism. By Captain Axet. *Memorial de Caballería,* Nov, '16. 3400 words]

Pacifists mention only the horrors and miseries of war. They ignore the vast benefits that war has brought to mankind. The progress and civilization brought about by war have more than compensated humanity for the suffering entailed. It is a mistake to believe that theorists will be able to abolish war.

The King of Bohemia formed a *league of peace* in the fifteenth century. Voltaire in the 18th, and Hudson Pratt in the 19th, both assured the world that future wars would be impossible. To abolish war, man's nature must be changed and historical rivalries, race hatred and commercial expansion must disappear together with all other strong opposing interests.

[About Pacifism. By Capt. Axet. *Memorial de Caballería,* Dec, '16. 2000 words. (Continuation.)]

Common sense, a knowledge of human nature, and the lessons of history all serve to reduce to Utopian dreams the pacifist ideals of a universal and perpetual peace. It can at least be said of war that it has not retarded the growth of knowledge or blocked the progress of civilization. In fact war, and nothing but war, has been the propelling instrument of European civilization. During the present war arts and sciences have advanced in marvellous strides. Practical measures to substitute for war must be found before it can be abolished. Among the measures advocated by pacifists are: tribunals of arbitration, the replacement of monarchies by republics, and disarmament. A tribunal of arbitration would be helpless without an army and navy to enforce its decisions. It is hardly probable that nations could be induced to disarm when by so doing they would place themselves in the power of such a purely mercenary force as an international army and navy would be.

The establishment of republics has not tended to reduce the number of wars either in Europe or the Americas.

The idea that dissolution of permanent armies would end all warfare is fallacious by reason of the nature of things. Permanent armies are relatively modern institutions, while war is as old as history itself.

Modern armies represent the very spirit of democracy. To oppose these institutions comes very close to advocating anarchy.

(To be continued)

[About Pacifism. By Capt. Axet (continuation). *Memorial de Caballería*, Jan, '17. 2300 words.]

Permanent armies do not exist in consequence of armaments, as pacifists contend, but as necessities to maintain internal security as well as to enable states calmly to confront serious international issues.

The army of to-day constitutes the genuine representation of the vitality and energy of the country. It is the advanced sentinel of its integrity, its independence, and its interests.

(To be continued)

[About Pacifism. By Capt. Axet. *Memorial de Caballería*, May, '17. 2000 words.]

(Continuation of a preceding article.)

The works of Pacifists generally contain as serious arguments against war familiar accounts of death, wounds, suffering, etc. This fact indicates that Pacifists have studied war as something separate and apart without taking into account its relationship to man and society. As a matter of fact war is in close relationship with all that goes to represent the organism of a state. It is connected with politics, thru rights of war; with legislation, thru penalties and recompenses; with medicine, thru the sanitary services; with physics, chemistry, and mechanics, thru improvements in the elements of strife; with civil institutions, thru methods of recruiting, organizing and forming armies; with pedagogy, philosophy, and all that represents art and science, because, as has been truly said, it has become an art for the commander, a science for the officer, and a trade for the soldier.

From each battle surges some grand idea. Military victory is the fount of future greatness. Imperial Rome with her triumphant legions civilized Gaul and built up the Spanish cities. Alexander the Great carried to the Ganges the thoughts of his master, Aristotle with the *Iliad* of Homer. Without wars art and science would still be hidden in the gloom of prehistoric ages.

(To be continued.)

[About Pacifism. By Capt. Axet. *Memorial de Caballería*, June, '17. 2300 words.]

(Conclusion.)

Economic science has come to naught thru its noble ideals of pacifism. Moral force, intellect and technique are helpless without an armed force to guarantee their prestige. Defenseless nations are ever menaced by foreign domination. The threat of either pacific or armed invasion is never absent.

It may as well be stated frankly that war cannot be abolished. Whether it be regarded as a calamity, a necessity, or an advantage, it will always impose itself upon the human race. Power of arms is the only guarantee of economic development and personal liberty.

[The New Morality. By Arthur Kitson. *Land and Water*, June 21, '17. 2200 words.]

The war has brought to view nothing stranger or more curious than the new Moral Code which Pacifists are busy preaching and expounding.

When the news of the horrors perpetrated in Belgium and northern France first aroused the anger and indignation of the civilized world, there arose a strangely discordant cry from several little groups of persons who have hitherto claimed an abnormally high standard of moral culture, who pose as the friends of humanity, and who regard Nationality and Patriotism as beneath contempt.

The cry of these persons was raised, not against the Germans, but against the Allies, and especially against their own country for following the path of duty and honor.

Apart from these men, there are those who are opposed to this country's participation in the war from what they believe to be conscientious motives. Their moral code contained no provision for hostilities, hence they fell back on the doctrine of non-resistance.

This doctrine is an old one that has been courageously followed by thousands.

We properly revere and praise the memories of the "noble army of martyrs" who suffered for what they believed to be the truth and met aggression with non-resistance.

Are the Pacifists entitled to rank as martyrs—altho in an unworthy cause? There are certain facts which throw suspicion on the general movement. The same people who professed to wish their country to turn the other cheek to the Hun smiter, fiercely resent not merely being smitten themselves, but *even being controlled* by their own government.

The most notable difference, however, between the old martyrs and modern Pacifists is that the former did not ask others to suffer, but offered themselves as victims, while the present Pacifists and conscientious objectors are perfectly willing to have others suffer while they occupy places of security and ease.

Those who endeavor to establish international policy based solely upon the sermon on the mount seem to be chasing shadows. Those teachings were intended primarily for the guidance of individuals in their own private lives. They cannot rightly be applied to nations in their corporate capacity under the conditions which now exist, and which have existed in the past. When the young man was advised to sell all he had and give to the poor, the advice did not imply that he should dispose of any funds entrusted to his care belonging to others, and it is not the part of a government to sacrifice or endanger the lives, liberties, or interests of the subjects whose welfare it has sworn to protect, in the pursuit of some merely idealist, or altruistic purpose.

The first duty of a government is the safety, care, and welfare of its own subjects.

PENSIONS, Military

Canada

[Canadian Pensions. *The Canadian Military Gazette*, Mar 13, '17. 700 words.]

As a result of the war, Canada's pension bill will be about twenty million dollars a year. The scale of

PENSIONS, Military—Continued

pensions for total disability runs from $480 for rank and file to $2700 for a brigadier-general or an admiral. For partial disability, claimants are rated under six classes, the pension being graded according to the injury. Additional allowances may be made when the pensioner is absolutely helpless. Artificial limbs and vocational training are also provided for. Widows and children of widows will receive the pensions to which husband and father would be entitled.

Already many fraudulent claims have been presented to the Government, and an investigation department has been organized in order to prevent the perpetration of fraud.

Great Britain

[Note. *Army & Navy Jour.*, Mar 17, '17. 125 words.]

On Mar 10, the British Ministry of Pensions had charge of 140,275 disabled men, 378,466 dependents of disabled and deceased men, 65,000 men in hospitals, and 65,000 men physically unfit. There is a $500 gratuity scheme which in its entirety would involve a capital charge of $1,980,000,000 for the first two years.

PERISCOPES

—For Artillery

[Improvised Periscope for Use in Plotting Rooms Not Connected with an Observing Station. By Major H. E. Cloke, C.A.C. *Jour. U. S. Artillery,* July-Aug., '16. 500 words. Illus.]

This device was constructed at Fort Flagler of materials on hand and by post labor. It was found to assist materially the accuracy of plotting, by enabling the plotter personally to see the movements of the target, and to note its changes of course. Personal observation by the plotter was found to give more satisfactory results than information furnished by the observers.

The mirrors are ordinary plate glass, and the tubing ordinary ventilator piping about twelve inches in diameter. If the device be non-telescopic (as in the case of the design shown in the article) the operator should use field glasses in connection with it.

—For Artillery Fire Control

See

FIELD ARTILLERY—FIRE CONTROL—INSTRUMENTS AND EQUIPMENT

PERSHING EXPEDITIONARY FORCE (Mexico)

See

MEXICAN BORDER MOBILIZATION (1915-17)—PERSHING EXPEDITIONARY FORCE

PERSIA

See also

EUROPEAN WAR—GENERAL NOTES ON OPERATIONS, BY THEATERS—SOUTHEASTERN THEATER—THE CAUCASUS

—Travels in

[A Diary from the Caucasus. By A. T. *Voenny Sbornik,* June, '16. 4000 words.]

(This is a popular account of a journey made by the author into Persia, and relates his experiences during his travels, mostly by caravan routes in the interior of the country. His story has no connection with military events in Persia, and is of interest solely as a narrative.)

PERU

—History

See also

CHILEAN-PERUVIAN WAR

SOUTH AMERICAN WARS OF INDEPENDENCE

PHILIPPINES

See

HONDAGUA, PORT OF

PHOTOGRAPHY, Military

See also

BALLISTICS—EXTERIOR (Article: "Motion Pictures of Projectiles in Flight")

—Aeronautical

[Military Airplane Photography. By Arthur Brock, Jr. *Aviation,* May 15, '17. 3948 words. Illustrated.]

Even before the Civil War, attempts were made to take photographs from captive balloons. The art of photography, however, had not sufficiently advanced at that date. The results obtained from photographs were such in the details and correct location of objects that from the earliest military use of airplanes the importance of photography was understood. The primary object of airplane photography is to obtain a complete and perfect record of that part of the terrain seen from an airplane; the secondary object is to obtain a record in large enough scale to permit the recognition of most of the points of importance; while the third is to permit the placing of the various objects as seen on the photographs, in their true location on the map. One result of such photographs has been to change entirely the manner of placing field-guns, since now a well marked gun-pit does not necessarily denote the presence of a gun, as there may be found three or more well marked gun-pits to each gun in actual use. The military application of the first object has resulted in the terrain being photographed daily, in some cases twice a day, to show the relative positions of the trenches and placements, as the differences in position are important evidence of the moves of the enemy, while at the same time conveying very valuable information as to the numbers of troops, gun-positions, and intrenchments. Until quite recently the average scale of military photographs was about 1/5000 actual size. Since this is the scale of a true horizontal photograph with a 12-inch lens at 5000 feet elevation, it is obvious that with the increased trajectory of anti-aircraft guns in some instances lenses of extreme lengths were used. The last object of military photography is to place all enemy positions in their true position on the map and to permit the calculation of ranges to points otherwise of unknown distance. It is evident that the features of an airplane camera tending

to simplify and add to the information contained in the maps will largely govern the design. The principal difficulty encountered in mapping positions from airplane photographs has resulted in various methods of attachment to the body designed to obtain approximate or absolutely true horizontal projections of the earth's surface. In general, none but the very best types of anastigmat lenses are used for airplane cameras. First, because of their large openings and second because of their better correction. Besides the long focal lengths are used, which can in some instances be advantageously replaced by a tele-photo combination. The standard sizes of the negatives of military aeronautical cameras have been adopted partly as a result of the type of lenses used, but more to conform to the standard sizes in use in the country, and whether films or dry-plates were used. In Europe, the increasing use of long focus lenses has resulted in a very considerable increase in the use of the large plates. A good example is a standard military camera of magazine type, containing eighteen 4 x 5-inch glass plates, with a 10½-inch lens. The weight of the military airplane camera has now to a certain extent become a minor consideration. One long focus type used by one European army is said to weigh 180 pounds. At the present time the lifting capacity of the reconnaissance military airplanes does not permit photographing at elevations beyond the range of the anti-aircraft guns, although hits are rare on the low photographic flights, yet the improvements in the anti-aircraft gun sights and shells may yet cause photographic flights under European conditions to be made at 18,000 to 20,000 feet elevation. The growth of airplane photography in Europe has been largely due to trench warfare. Furthermore, the accuracy and the scales of the military maps have to a large extent simplified the work, thereby permitting a sufficiently complete set of data to be obtained from a number of individual photographs, taken approximately horizontal. The photographic work of the United States Army will therefore be more in the nature of actually constructing military maps. The importance of this has been fully understood by the officers of the Aviation Section of the Signal Corps, and with their assistance and co-operation it has been possible to design and perfect a number of photographic instruments to accomplish the following results:

First: To make any photographic series into a plan view map.

Second: To show relative elevations of the ground positions when desired in any photographic flight.

Third: To print any photographic series into a photographic map, and

Fourth: The processes are as nearly mechanical as it is possible to make them.

The scale upon which the United States Army photographs will ordinarily be made ranges from 1/2500 to 1/5000 actual size. A very distinct advantage is obtained from the 4 x 5 size, in that the work of producing hundreds of prints per day per squadron, as is the case in war conditions, is minimized. In Europe it has been found advantageous to furnish photographs of their section to the regimental units, the brigade commanders, and the corps commanders.

[Photography from Aircraft. By Col. Dion Williams, U.S.M.C. *The Marine Corps Gazette*, June, '17. 4000 words. Illustration.]

During the last year of the Civil War, photographs were taken from captive balloons on the lines between Richmond and Petersburg. By 1870, the time of exposure to produce practicable results had been cut down to 1/20 of a second, and the French succeeded in taking photographs from both captive and free balloons.

In order to get a photograph of a portion of the earth's surface in true place, the camera should be pointed vertically downward.

"It is very difficult to ascertain from the position of the photographer in an airplane above the ground the exact degree of such inclination at the time of exposure; but once this angle is ascertained it is a comparatively simple matter to bring the picture to the true proportions by rephotographing the original picture with the copying camera inclined at such an angle to the original picture as will correct the angle of obliquity."

Several types of copying cameras have been devised to correct aircraft photographs so as to bring all dimensions to correct proportions. Among these is the Scheimpflug-Kammerer perspectograph (illustration).

In mapping by photography, camera vertical, only the terrain immediately below will appear in true plan. The outlying portions will be distorted in the ratio of the distance of any point from the focal center of the photograph. Hence in mapping by photography from aircraft only a small area can be covered by one exposure, if great accuracy is desired. To get a wider field, Scheimpflug devoted his combination aerial camera [illustration]. This consists of a central camera, to be vertical, and seven others, disposed at a known angle on a circle around the central. All eight are exposed simultaneously, and if the central be truly vertical, the obliquity of the seven others is known. On developing, the seven outer plates may be reduced perspectographically, thus producing one picture, corrected for obliquity and with scale correct.

If the ground be hilly or sloping, other errors will be introduced, to be corrected only by the knowledge of the ground obtained from a contoured map.

A cursory examination of any aerial photograph shows that important military details are more quickly depicted by this method than by any other. The enlargement of such a photograph either by rephotography or by projection brings out many details, so that successive photographs of the same area will show changes in a military position or situation, and enable suitable modification of a plan to be made. Powerful telephoto lenses will give details from great heights, but motor vibrations are likely to ruin the picture; this prevents their use in airplanes, but not in dirigibles. Various attempts have been made to apply moving picture cameras to aerial photography [descriptions and illustrations], but these on the whole have failed. The excessive vibration of the airplane motor pro-

PHOTOGRAPHY, Military—Continued

duced a "dizziness" in the picture that tended to obliterate all minor features, and it was found that good pictures could be obtained only by volplaning with the motor stopped.

PHYSICAL TRAINING, Military

See
GYMNASTICS, MILITARY

PISTOL

—Automatic

See also
CAVALRY—ARMS—PISTOL

PONTON BRIDGES

See also
CAVALRY—SPECIAL DUTIES

PORTS

[Ocean Transport and Commerce. By Sir Douglas Owen, Kt. *Jour. Royal Artillery,* Jan, '17. 7500 words. (A lecture delivered at the Royal Art. Inst., Woolwich, Thursday, Dec 21, 1916.)]

The History of Ports

When we picture to ourselves a port, we imagine a terminus or starting-point for ships. But a port is much more than that, it is a forwarding and collecting center.

The ancient ports on the sea began in a small way and grew bigger, as the land and shipping facilities developed. City and port grew together. But the greatest and most important ports of Europe are not on the sea at all.

In ancient times, the trade tracks or traveled roads of a country sought crossing places of rivers which had to be crossed, at some point where the river could be negotiated by ford or ferry. This is illustrated by the situation of London. The Thames formed an impassable barrier between north and south, with wide marsh land on both sides. At only one spot did a point of land project itself to the river's edge, *viz.,* the Tower Hill of to-day. Roads converged on this point from all directions and a city gradually grew up there which is the London of to-day.

There was no selection about these ancient river ports. No doubt there were many advantages in their locations on tidal rivers, but their modern prosperity can be maintained only at great cost for dredging and other port works. If such ports were to be located today, undoubtedly they would be located nearer the sea where the depth at lowest tides is ample for the big ships.

Two facts stand out clearly; first, the ancient up river port is nowadays under great disadvantage by reason of its situation, and second, the success or very existence of a port is bound up in its railway service.

The Railways and the Ports

The railway companies early saw the advantages of connection with a sea port and spent vast sums to create ports on their systems, not for what they expected to make out of the ports but to create traffic over their entire systems. But with the creation of a new port, ships and trade for it do not spring into being. They have to be drawn or attracted from rival ports, which can be done only by offering some advantages in transportation rates or reduced cost of handling freight. These reductions must be met by the old ports by corresponding reductions, enabling manufacturers to export goods at less expense.

A port is not a terminus but a conduit pipe where ship and railway meet. Any failure to maintain the port facilities or to provide it with ample railway facilities inevitably results in the diversion of its trade. In fact the enormous development of manufacturing facilities and the struggle of the railways to get possession of its transport are bringing about a grandual change of conditions, whereby we are getting back to ancient conditions of out-ports supplying their own hinterland at least with raw materials for factory and shop.

The Port and the Market

A port, in addition to being a port of transit, may likewise be a port of distribution or market. London is a notable illustration. London not only has a large population, but here are congregated buyers and sellers and dealers in goods of every description. Goods landed elsewhere must be sent to London to be sold since the routes and establishments of trade, once fixed, are hard to disturb. Goods cannot be sold at the port unless the buyers and sellers congregate there, or unless it is a market. And a port which has no market is a stepping stone either to a market or to an industrial center to which it is linked by railway systems.

Port Rivalries and the Passenger Factor

In old times, the passenger was tolerated rather than encouraged and competed for, and space was grudgingly allotted to him on the cargo ship. But with the increase in wealth, population, and education in the world, people began to travel and the fast passenger ship has been evolved. Size was one of the chief considerations and also travelers desired speedy voyages by the most direct routes. Therefore arose the great passenger ports on the direct lines of travel, to which the large passenger steamers transferred their home ports. The passenger steamers, while built primarily to carry passengers, also carry large quantities of perishable or valuable freight which is obliged or can afford to travel by the quickest and most direct routes. Hence a port which loses its passenger traffic also loses this special goods traffic as well. In addition, traffic is brought to the liners by coastal and other ships, and the loss of the great liners means the loss of these other ships as well.

The Out-growing Ports

In fact which upset all the calculations of engineers is of recent discovery, that in ocean transport size means cheapness and increased profit. Hence the great increase in size of ships to which there seems to be no limit. This constant increasing of size of ships throws a great burden on the ports which must

provide facilities or lose their trade to some more enterprising rival. This great and costly struggle is a remarkable incident of modern ocean transport.

The Ship and the Market

In ocean transport every penny counts, and it is alleged that ships will take their trade elsewhere if driven to it. But ships will go where commerce calls them. Wherever a cargo is required the ships will compete to get it, only in fixing their charges for freight, they charge a rate which takes into account all the disadvantages. When freight rates become excessive, the owners of the goods then look for alternative routes. In other words it is the port which holds the key to the situation and not the ships.

The Economics of Port Construction

Industrial developments incline to follow the line of least resistance. In different ports, the methods of port construction may vary with local conditions but the great principle will be found the same. This principle is concentration, the bringing together of goods, traders, carts, railways, and ships. Traders insist that no river shall come between them and their goods, and if, because of the growth of the port, ships must land their cargoes at a distance from the town, let them be landed on the same bank as the warehouses. Why discharge goods on the wrong side of the river and incur the cost of lightering and double handling to bring them over. One of the reasons which in England has told against transport by canal is the fact that the canals and locks are not all of the same gauge, thus involving double handling in transshipment to other systems.

The Proposal for Damming the Thames

This proposal to construct a dam with a weir and ship locks across the river at Gravesend, so that ships could enter at any stage of the tide and pass at once into a great deep water dock with quays on both sides from London to Gravesend. The objections are most serious in that the locks could not be operated fast enough to accommodate the shipping; the uncertain sanitary effect of abolishing the scour of the tide; the costly artificial drainage of surrounding lands necessary if the river were kept always at high tide; and trade of the port would be seriously interfered with during the construction of the dam.

Barge Canals

Comment often is made as to why the canals of Great Britain appear so neglected as compared with the canals of Germany and Holland. Germany has fewer railroads, a smaller coast line, and many large rivers on which are many large cities. The location of the rivers is ideal for the development of the canal system. England has many railroads, a large coast line, and no large rivers. The large cities are on the railroads.

In Holland the canals are necessary for drainage, the soil is not good for roads, and hence the canals serve the double purpose of roads and drainage.

PORTUGAL

See also

STAFF COLLEGES—PORTUGAL

POSTAL SERVICE, Military

—Use of Airplanes in

[The First Permanent Aero Mail Line. By Lieut. Mario De Bernardi. *Flying,* Sept, '17. 700 words. Illustrated.]

On May 22d and 26th, 1917, I twice made the trip from Turin to Rome by airplane, carrying mail. On May 22d, after five days of rain, it seemed that the weather would be fair. On that morning, at 11:20, after swift preparations and loading mail-bags on my Pomilio aeroplane, I started from the aviation camp. The wind was against me so I flew at 800 meters, and directed my machine toward the Apennine Mountains. Subsequently I climbed to 1300 meters, and as the clouds were thick, and I could not see the ground I directed myself entirely by compass.

In this first trip, instead of flying direct to Genoa, which is on a straight line from Turin, I flew to Savona. Following the route, I passed Portofino, then over Spezia, meeting better weather, but my machine and myself being beaten every now and then by showers and wind. Before reaching Piombino, the persistent rain was back and was with me until I passed Civita Vecchia. Towards Rome the weather was better. I descended over the Centocelle aviation camp, when a violent puff of wind struck the aeroplane as I landed, and caused one of the wheels to strike a pile of rubbish in the field. I had accomplished the trip in four hours and three minutes, the distance being 635 kilometers.

On May 26th, I started again from Turin under better weather conditions. The start was made at 11:25 a. m. and I stopped at the aviation camp at Pisa to transmit the cordial greeting to the aviators there from the aviators of Turin. I arrived at 12:37, having taken one hour and 14 minutes to cover the distance between Turin and Pisa, 285 kilometers. The distance between Pisa and Rome was covered in one hour and 35 minutes. I started from Rome the following day, again in horrible weather. Twice I pointed the machine towards Turin, but it was in vain. The gale forced me back each time. So I decided to turn back and landed at Lavagna. Starting from that small place was not the easiest thing in the world, but I succeeded in starting the motor, and by flying towards the sea, altho the wheels almost touched the water, I succeeded in getting away without trouble. After circling the village, I turned and flying over the Apennines returned to Turin.

POSTS, Military

See

BARRACKS

POWDER

See also

EXPLOSIVES

—Smokeless—Manufacture of

[American Powder Best. *Army & Navy Jour.,* Mar 3, '17. 700 words.]

POWDER—Continued

Hudson Maxim asserts that America has led the way for European nations in powder manufacture, that a rifle developed here has a life of 20,000 rounds altho formerly rifles had been good for only 3000 rounds, and that powder used in big guns in this country causes less erosion than that used in any other country.

[British Smokeless Powders. *Arms and Explosives,* June 1, '17. 5000 words. Tables and illustrations.]

(This is a continuation of an article in the May issue of *Arms and Explosives* [not received—Ed.] in which the development of smokeless powders by the British manufacturers is traced. A brief statement is given of the development work done by the Schultze Gunpowder Co., Ltd., the New Explosives Co., Ltd., the "E. C." Powder Co., Ltd., the Smokeless Powder Co., Ltd., the Nobel's Explosives Co., Ltd., the War and Sporting Powder Syn., Ltd., Curtis & Harvey, Kynoch, Ltd., and Henrite Explosives, Ltd. The composition of powders made by these firms at various dates is given.

The development of smokeless rifle powder followed the development of smokeless powder for sporting use in shotguns. The development in Great Britain of smokeless powders for rifle use received a severe check by the adoption by the Government of cordite in 1890.)

PREPAREDNESS FOR WAR

[Preparedness a Vital Necessity. By Lieut.-Commander John P. Jackson, U. S. Navy. *Proc. U. S. Naval Institute,* Sept-Oct, '16. 10,000 words.]

There is no place in the present order of things for a weak nation. The day has passed, if it ever existed, when a people can consider itself immune from war because it does not desire it.

Probably never in history has a country received such a salutary warning, and had such an advantageous opportunity to retrieve its errors. The public must be aroused from its lethargy of indifference and educated in military matters.

(How this can be accomplished is the subject of this article.)

[Military Prudence. By Commander A. W. Hinds, U. S. Navy. *Proc. Naval Institute,* Sept-Oct, '16. 560 words.]

In connection with the study of the probability of peace or war for the United States, there must be taken into account the natural causes of war for this country. These are: 1. The Monroe Doctrine; 2. The Open Door; 3. Trade Jealousy; 4. Racial Jealousy; 5. Disposition of the Philippine Islands; 6. Immigration Questions.

Under the head of preparedness the author discusses "Our Sins of Omission."

Sin No. 1. Lack of a National Council of Defense.
Sin No. 2. Lack of a Navy General Staff.
Sin No. 3. Lack of Naval Bases.
Sin No. 4. Lack of Battle Cruisers.
Sin No. 5. National Extravagance.

To prepare, as far as the navy is concerned, certain things should be done:

1. Lay down national policies and build ships to fit them.
2. Provide for a General Staff and accept its recommendations.
3. Prepare proper naval bases.
4. Do not wait until war is forced upon us, but begin to build a properly balanced fleet and begin now.

[A Laboratory for Defense. By Thomas A. Edison. *Journal Military Service Institution.* Sept-Oct, '16. 900 words.]

(The noted inventor suggests the establishment of a laboratory for the development of war machinery by the government.)

[Theorists vs. Everybody Else. By Lieut.-Col. W. H. Hart. *Jour. Military Service Institution.* Jan-Feb, '17. 1500 words.]

This article is a preparedness argument based on the elementary traits of human nature, national and in evidence. Divested of irrelevant matter, the respective appeals are clear-cut. One urges that free men gird their loins to resist any covetous and unprincipled aggressor. The other, counsels the same free men to abide empty-handed, and if assailed, to answer softly. While the theorist racks his brain to prove that war can be done away with, practical men see but the fact that war still exists, is more virulent than ever before. The pacifist writes volumes to prove that war is a senseless waste. This the average man freely grants; but, he wants to know if that fact should reconcile his soul to supine submission while an unscrupulous invader forces dishonor upon him.

[Cheap Things Are Dearest. By J. E. Rodriguez, Colonel. *Rev. del Circulo Militar,* Mar, '17. 700 words.]

However burdensome the expense of military preparedness may seem, it assures peace and permits the state to develop its resources in security. Where proper measures of defense have been neglected, whether from false ideas of economy or faith in the utopian doctrine of peace, there will in time come to the people a day of rude awakening. Regrets then will be too late and the banner of peace will not safeguard the national honor.

Common sense and the instinct of self-preservation point to the necessity of providing for the national defense; the military requirements should be the basis of the annual budget instead of as now, a mere appendage to the general appropriation.

While Argentina is diminishing her military appropriations, our neighbor, Chile, with more foresight, is steadily increasing hers and has just added six submarines to her squadron. The opening of the canal thru the Isthmus of Ofqui will add greatly to the offensive and defensive power of Chile at the southern end of her territory, giving her a secure and well protected base for torpedo boats and vessels of small tonnage.

—Mobilization of National Resources

Germany

[Technical and Industrial Preparation for Military Success. By Capt. B. Zschokke, Engineers (Switzerland.) *Schweiz. Zeit. f. Art. u. Genie,* Feb and Mar, '16. 8000 words.]

The military resources of a nation may be classified as material and intellectual. Under the first we consider the physical characteristics of the people, the numerical strength of the military forces, their organization, armament and supply. Under the second we consider the culture and intelligence of the people, the genius of their leaders and higher commanders, the theoretical and practical training of the officers and men, and the spirit of the armies. The greater the perfection in all these factors, the better will the military forces succeed in accomplishing the objects of war. If we consider the factor of numerical strength, it is evident that Switzerland cannot raise an army of more than 400,000. If we make a comparison of the belligerents, based upon the above factors, it is strikingly evident that in two points Germany is superior to all of them; namely, the technical and industrial preparation for war, and in the perfect co-ordination of its military machine. If Germany has succeeded, in spite of seemingly overwhelming difficulties and obstacles, in keeping her forces armed and supplied, and in making herself absolutely independent of foreign nations, this condition is due entirely to her wonderful development in all industrial, scientific and technical industries. To this, rather than to the genius and strategy of her leaders, may be ascribed the successes which Germany has attained.

Conditions in Switzerland are far more unfavorable than they were in Germany at the beginning of the war, and it therefore behooves us to study this matter and to develop our military, technical and industrial resources. Most important are the metals and industries based thereon. Of these, the most important are iron and coal with which Germany is plentifully supplied. Altho the ammunition used has surpassed all previous calculations, Germany has always succeeded in meeting her requirements. In Russia, the lack of ammunition has been a serious problem and is now generally acknowledged to have been the impelling reason for the general retreat of her armies between May and September, 1915. England, in spite of enormous importations of ammunition from America and Japan, has still the greatest difficulties in this respect.

The use of chrome steel and nickel is so important in modern ordnance that Germany is experiencing great difficulties in supplying this deficiency. Since the sources are all foreign, Germany is compelled to cover it by confiscation of all objects made of these metals. With respect to copper, the conditions are also somewhat similar. Before the war, 261,000 tons of copper were used annually, whereas the production was only 49,000 tons. The confiscation of copper mines in Serbia has partly covered the deficiency.

The supply of lead, zinc and tin is probably adequate for all military needs. 1913 production follows:

Metal.	Produced.	Used.
Lead	181,000 tons.	223,500 tons.
Zinc	283,113 tons.	223,000 tons.
Tin	11,500 tons.	19,000 tons.

A very important metal is aluminum, with which Germany is plentifully supplied. This metal is used exclusively in the construction of all aircraft. Mercury is another important metal, being used in fulminates and sublimates. In 1901 Austria produced 552 tons of mercury against 2873 tons for the rest of the world. Fortunately very efficient substitutes have been found for the fulminate of mercury.

Taken all in all, Germany is adequately provided with all metals it requires excepting chromium, nickel and copper, but for the latter efficient alloys have been substituted.

Just as important as the metals are the minerals, chemical compounds, and other ingredients required in the manufacture of powder and explosives. These are saltpeter, sulphuric acid, cotton, toluol, phenol, glycerine, ammonia, potassium carbonate and ether. The high development of German chemical industries has made Germany practically independent of all foreign sources in everything except cotton. The allies are still unable to meet their requirements at home and are constrained to import enormous amounts of material from America, Canada and Japan.

Almost all the world's supply of *saltpeter* has heretofore come from Chile. Of the 2,274,000 tons exported in 1910, 896,225 tons were exported to Germany. Since the outbreak of the war this source has been cut off, but by means of the electrical method of Birkeland and Eyde, oxygen and nitrogen are taken from the air, forming nitric acid, which is then oxidized into saltpeter. Another method used is that of Prof. Haber. Both these methods are being used to produce saltpeter in sufficient quantity to cover all military requirements. Had Germany gone to war 15 years ago she would have been compelled to lay down her arms for lack of saltpeter. In the manufacture of smokeless powder *sulphuric acid* is a most important agent. In times of peace the manufacture of this acid was based upon pyrites imported from Sweden, Norway and Italy. The first two sources are still open and in the meantime Serbia has also furnished copper pyrites for this purpose. It is believed that German chemists have also succeeded in obtaining sulphuric acid from other compounds of sulphur.

In 1912 the importation of *cotton* was as follows:

United States	422,310	tons
Egypt	40,907	"
British India	38,385	"
Turkey	884	"
Other Sources	4,495	"
Total	506,981	tons

Since August, 1915, this supply has been absolutely cut off and substitutes have had to be used. These have been formed of wood, straw, paper, jute, and fibrous plants containing a large percentage of cellulose.

PREPAREDNESS FOR WAR—Continued

The base of nearly all high explosives is *trinitro-toluol* and *picric acid*. Both are coal tar products, the first being obtained from *toluol*, the second from *phenol*. From 100 kg. of coal about 5 kg. of coal tar is obtained. The distillation of this will produce about 7½ to 15 g. toluol and 25 g. phenol, from which 18½ to 37 g. of trinitro-toluol and 61 g. picric acid are obtained. It is apparent what an enormous amount of coal is necessary to produce the required amount of trotyl and picric acid. Tar is a by-product of the coke industry which is used extensively in the iron trades. Other by-products are ammonia and benzol. These facts account for the intimate relation between the iron and coal tar industries in Germany. Altho England far surpasses Germany in the production of tar, it is completely outclassed by Germany in the production of coal-tar products.

Glycerine is obtained by the saponification of animal and vegetable fats, of which there is a great shortage. Since other explosives have been substituted for nitroglycerine, a shortage in glycerine will affect only the civilian requirements. *Ether* is obtained from alcohol and concentrated sulphuric acid.

There is undoubtedly a scarcity of *rubber* in Germany to-day. In 1912 Germany imported one-fourth of the world's product. It is believed that the German chemists have succeeded in producing rubber synthetically or to make substitutes for certain important rubber articles.

There is also a great scarcity of grain, meat fats, milk, rice, wool, leather, tea, coffee, cocoa, chocolate. The following statistics are taken from the "Year Book of the German Empire for the Year 1913":

Year 1912—	1912. Tot. Crops. Tons.	1912. Tot. Impts. Tons.	1911–1912. Amt. Cons'd. Tons.
Wheat	4,360,624	2,485,955	5,759,151
Rye	11,598,289	332,994	9,209,753
Barley	3,481,174	2,934,805	6,378,046
Oats	8,520,183	804,294	7,253,434

Year 1912—	Slaughtered for Home Consumption.	Imported.
Oxen	523,149	39,374
Bulls	421,772	6,897
Cows	1,727,621	85,721
Heifers and Steers	961,452	68,383
Calves	4,360,326	.....
Hogs	18,196,343	133,291
Sheep	2,263,423	.....

In addition about 250,000 tons of fresh and canned meat were imported.

Imports, 1912—	Tons.
Rice	100,450
Coffee	170,867
Cocoa Bean	55,085
Tea	4,138
Chocolate	1,929

Year 1912—	Import. Tons.	Export. Tons.
Cotton, raw	506,981	49,198
Cotton Waste, raw	35,413	4,387
Cotton Waste, worked	55,448	42,638
Cotton Goods	37,487	82,688

In 1912 the *potato crop* was 50,209,466 tons; the amount consumed only 28,838,011 tons. In the same year the imports in *wool products* amounted to 280,643 tons, the exports to only 84,648 tons. In *mineral oils* the imports from countries from which the supply is now cut off totaled 1,001,215 tons, from Austro-Hungary 184,250 tons, from Rumania only 95,228 tons. Since the greater part of the Austrian product came from Galicia, it is easily understood how important was the reconquest of this province.

Germany has succeeded in holding its military superiority only by carefully planning her organization, armament and industries. If she had not done so, she would to-day be impotent, in spite of her well-trained armies and efficient leadership. Such problems can only be solved if the nation has at its disposal a superior and talented body of men who, free from all bureaucratic prescriptions, can devote their efforts and their lives to military problems, and questions of industrial and technical preparation. To understand the thoroness of the German system, one must go deeper into their organization and methods. We can then appreciate with what care they select their higher commanders and general staff officers, and what emphasis they lay upon their thoro education and training. If the German army has accomplished wonders in solving its industrial and technical problems, it is all due to the superior general, military, and technical training of its General Staff, its scientific methods, accurate knowledge of the country's resources, and to the co-ordination of all military, scientific, technical and commercial activities. A modern General Staff must occupy itself not only with strictly military problems, such as mobilization, transportation, supplies, information, topographic surveying, military history, tactics and strategy, but also study and be informed on all industrial and technical problems and the application of all progress along the indicated lines to the military efficiency of the country.

United States

[Industrial Preparedness. By Capt. Bascom Little, O.R.C. *Infantry Journal*, Feb, '17. 2100 words.]

It is intended here briefly to explain some of the ideas of the U. S. Chamber of Commerce on Industrial Preparedness and on some of the sections of the National Defense Act. Somewhat unwillingly have the business men of the country turned their attention to national policy. National consciousness has been aroused by the first real danger in fifty years. To the general question, "Shall we prepare?" in the National Chamber referendum, there was a response of 970 to 8 in favor of the proposition. After an inventory of what stock the nation had on hand, it was resolved that the Navy should be made second in the

Atlantic and first in the Pacific, as our first line of defense; and that the Army should be increased and have a proper reserve, as a second line. The details were to be left to experts.

To have all the elements of national strength welded and bolted so that they would function like one great engine, would necessitate that no part of the nation be left out. Accordingly the Chamber voted for universal and compulsory military training.

The members realized that if man and ship-power were to come to their full efficacy, they must have behind them an organized industrial power. The Chamber therefore conceived of a Bureau to be called a Staff of Industrial Mobilization, which should bear the same relation to the President as does the General Staff of the Army. However the new Council of Defense as represented by its Director, seems to satisfy every condition.

Few people realize the immense amount of work already done along the lines of industrial preparedness, which would have faced the new Director. Mr. Howard Coffin, a member of the Naval Consulting Board, and also of the Council of National Defense, has organized about 30,000 civilian engineers into a body which has collected the data in regard to the equipment and property of 30,000 private manufacturing and mercantile companies. The report, which includes the machine-tool equipment, a description of the peace time product, and such other intimate information as could have been obtained only for this purpose, will furnish to the Director, a complete inventory of the country's productive capacity. In addition, two scientists, taking pains to find out what the Government would need in time of war, have tabulated the sources of supply of these necessities, and have furnished charts and card-indexes covering 52,000 items.

The Chamber believes that the Government should establish in the great industrial centres of the country district arsenals which should have the following functions: first, to be an experimental laboratory where manufacture of government supplies might be studied and new ideas developed; second, to be an instruction plant for its district so that the private plants under its control could be kept at the highest state of readiness; third, to be the inspection center for finished and semi-finished materials; fourth, to be the assembly plant. The private plants within the district should be under contract with the Government to keep in their stock rooms gauges and special tools required. Each year these firms should make only enough of their particular articles to satisfy the expenditure for tools. At least one of the seniors of the firm should be a member of the Officers' Reserve Corps.

The object of each private concern in this case is to be automatically metamorphosed into a smooth-working Government plant in case of war.

PRESS CENSORSHIP

[The Army and the Press in Time of War. By Major A. Ewing, Chilean Army. *Mem. del Ejército* (Chile), Oct, '16. 1950 words.]

The press of a country, so powerful in time of peace, has an important mission to fulfill in time of war, by co-operating with the plans of national defense. A well managed and well informed press can be a powerful aid; lacking in the above qualities, it can very often drag an army to complete disaster. If the press knows how to exploit the successes obtained, how to minimize the reverses suffered, how to stimulate the patriotism of the people and how to keep up at all times public interest, it will have fulfilled its mission. On the other hand, if it criticizes the conduct of the campaign, or demands the carrying out of new plans, or comments unfavorably on the appointments made and on the movements executed, it may unconsciously betray its own army, by giving certain valuable information to the enemy. At the same time, it may cause national distrust of those charged with the prosecution of the campaign.

During the Crimean War, the Russians obtained valuable information regarding the siege of Sebastopol from the dispatches published in the English and French newspapers. During the Civil War, the Northern Generals almost always obtained very valuable news from the Confederate newspapers. After the fall of Atlanta, Jefferson Davis made a speech in which he stated that the necessary measures had already been taken in Tennessee and Kentucky to prevent Sherman from receiving any supplies from the North. This speech was published in the Southern newspapers, and quoted by those from the North. When Sherman heard of this, he started on his famous march to the sea, which enabled him to receive the supplies which Grant had sent him.

In July of 1870, Major Krause of the German General Staff was able, thru the French press, to ascertain the organization and strategic deployment of the French forces. When McMahon started on his march to support Bazaine, who was then besieged in Metz, the German Commander obtained this information from press dispatches published in English and French newspapers.

During the Spanish-American War, the American press gave detailed accounts of the concentration at Tampa. This lack of discretion was also manifest in the Cuban and Madrid newspapers, which gave daily reports of the number of troops at the different points and of their morale.

Japan was the first country to assume complete control of the press during wartime. Coincident with the declaration of war against Russia, positive orders were issued forbidding the publication of any news relating to the organization, mobilization and transportation of troops. To show how well the press responded, it is necessary only to recall the mystery surrounding the movements of Admiral Togo and of Marshal Oyama.

In the present war, all belligerent nations have established a rigorous censorship. Great Britain has extended its censorship to the press, to the cables, and to the mails. Later, there was organized, in connection with the press censorship, a publicity bureau, the duty of which is to make use of the information favorable

PRESS CENSORSHIP—Continued

to the Allies, and to write articles in accord with the instructions of the Foreign Office. Permanent correspondents are not permitted on the battle fronts. Daily communiqués or bulletins are issued by the Commander-in-Chief. These are supplemented with weekly reports submitted by an eye witness, who generally is an officer attached to the Staff of the Commanding General.

Only one correspondent was permitted to accompany the Dardanelles expedition, and no information was published without first being approved by the censor. At the beginning of the war, the French Government put in force a decree enacted by Parliament in 1850, by virtue of which the military government had the right to suspend the publication of any newspapers disobeying instructions issued referring to the publication of military information. When the mobilization was ordered, prior to the declaration of war, the Minister of War organized a censor bureau. The Chamber of Deputies passed a law establishing military censorship during the continuance of the war, but limiting this censorship to military information and not to political matters.

On this subject, Germany, as with everything connected with the preparation for war, must be cited as a model. The law already provided for the status of the press as soon as mobilization was ordered. Special regulations covered all the details of press censorship. Furthermore, proper use has been made of newspapers and magazines to establish public opinion in accordance with the wishes of the Government.

As a result of this, the countries which had not paid much attention to the organization of the press prior to the declaration of war, have since made a special study of it. The General Staff of the United States recently submitted to the Secretary of War a memorandum on the subject. This memorandum has been made the basis of a tentative bill to be submitted to Congress.

Great Britain

[The Military Critics of the European War. *Mem. Del Ejército* (Chile), Feb, '17. 3500 words.]

The present war proves conclusively that the press exercises an enormous influence in the selection and execution of plans. Newspapers, thru their military critics, undertake to inform the public thru articles written in support of their interests or intended for home consumption.

Unfortunately, certain military critics have initiated a campaign in support of their tactical and strategical ideas. This action has exercised a pernicious influence in the resolutions of the Allied governments.

Of all the military critics, Colonel Repington, of the London *Times,* is the one whose writings have had the greatest weight with the Allied governments and war councils. His estimate of the situation and his conclusions, while the Serbian and Balkan campaigns were in progress, reveal an ignorance of economic and local conditions. The same thing may be said of the articles written during the Rumanian campaign.

Only strict censorship can prevent the publication of so many falsehoods and inventions which do more harm than good.

PRISONERS (of War)

See also

EUROPEAN WAR—PRISONS AND PRISONERS

[The Exchange of Prisoners of War. By Hugh H. L. Bellot, D.C.L., and Malcolm Carter. *United Service Magazine,* Nov, '16. 6600 words.]

(Customs of previous wars.)

[An Historical Parallel. Fourth Greek Army Corps and the Convention of Tauroggen. By Colonel Feyler. *Land and Water,* Nov 23, '16. 1700 words.]

(The writer cites a report to the effect that General Hazzopoulos, in command of the Fourth Greek Army Corps, which had been left in position on the Macedonian frontier, has arranged with the German higher command for the transport of this entire corps to the interior of Germany.

A parallel is drawn between this arrangement and the treaty known to military history as the Convention of Tauroggen, when the Prussian General von York, of Macdonald's Corps, surrendered to the Russians under General Deibitsch, on Dec 30, 1812.)

[Note. *Army & Navy Jour.,* Aug 11, '17. 250 words.]

British and German delegates in conference at the Hague recently reached an agreement regarding the treatment and exchange of civil and military prisoners. It was stated in the House of Commons, July 27, that this agreement had been ratified by both governments. Direct repatriation is to be resumed, medical grounds for repatriation or internment in neutral countries have been made more lenient, and the more seriously ill and wounded now in Switzerland are to be sent home to make room for others. Holland has agreed to accept 7500 persons for internment. All officers and non-commissioned officers in captivity more than 18 months are eligible for internment in neutral countries. Holland will accept 6500 of these, and 2000 civil prisoners, preference given to invalids. Punishments for attempted escape and other offenses have been regulated, and reprisals against individuals have been canceled.

PRISONS, Military

See also

DISCIPLINARY BARRACKS

EUROPEAN WAR—PRISONS AND PRISONERS

PRIZE MONEY

[German Prize Money. *Army and Navy Gazette,* June 23, '17. 400 words.]

In certain Prize Court proceedings in connection with the surrender of Tsingtau, it was stated that the Admiralty has learned the scale of German prize money which went into effect last February. Prize

money is awarded for ships brought into port, and prize bounty for those destroyed, the latter based upon the insured value of ship and cargo.

For ships brought into port, the commander and engineer receive each 5 per cent of the value, other officers 15 per cent, and the crew 25 per cent. For vessels destroyed, the commander and engineer receive each 1 per cent, the other officers share 4 per cent, and the crew share 10 per cent of the assured value. The awards apply apparently both to war and merchant vessels, neutrals included in the latter class. The bulk of the bounty must of course go to the German submarine service, but the oversea raiders must also have received large amounts. A special reward is given to the commander who destroys the greatest number of ships in one voyage. This explains why certain records of this character appeared in the German newspapers.

PROJECTILES

See also

Torpedoes—Aerial

[Contribution to the Study of Projectile Heads. By A. Sjökvist. *Svensk Kustartilleritidskrift,* Part 3, '16. 2900 words, 5 tables and 5 figures.]

This is a technical discussion of the theories and formulas of v. Lössel, Riabouchinsky and Alston Hamilton (U. S. Coast Arty.) relative to the resistance of the air to projectiles of variously shaped heads.

As an example taken from table 1, the value of the resistance to an ogival pointed projectile with a 2 cal. radius being taken as 1, the resistance to one of 0.5 radius is according to v. Lössel, 1.825; to Riabouchinsky, 1.361; and to Alston Hamilton, 1.910. The resistance to one of 9¼ radius would be 0.474, 0.518 and 0.470 respectively; while with a parabolic head (the same radius as last) the resistance would be 0.419, 0.445, and 0.472, according to the above mentioned authorities.

It was calculated that with a radius of the head equal to 8 calibers, *the percentage of increase* in the range of a projectile from a 30.5 cm. gun would be 39; of one from a 15 cm. gun, 42; and of one from a 24 cm. gun (with its lower velocity) 29; thus showing the great importance of having a suitably shaped point to the projectile.

[The Deadly Effects of Projectiles. By Capt. R. de Diesbach, Engrs. *Revue Militaire Suisse,* Jan, '17. 4400 words. Tables. 1 plate.]

I. *Introduction*

It would be presumptuous to deliver a final judgment about the deadly and destructive effects of projectiles before the end of the present war. We must wait until military critics have deduced from the lessons of experience the principles which will assure the defenders efficacious protection against the fire of an assailant.

Such deductions as were made from the sieges of Port Arthur and Adrianople as to the effect of fire on defenses and defenders would not appear conclusive in the light of more recent events. The belligerents of to-day have made war a matter of machines and have taken advantage of all the progress realized in armament, electric tele-communication, automobiles and aviation. Now, automobile traction brings heavy artillery up opportunely, and keeps it supplied with ammunition; it is no longer dependent on the railroads. It is equal in power to the fortress guns. The precision and rapidity of fire of field batteries, the intensity of rifle fire, the generalized use of machine guns are so many factors that seem to have had a decisive influence on the stationary character of the operations.

The adversaries have not hesitated to intrench along their whole front. They have resorted to all the varied resources of modern semi-permanent fortification.

For the violent offensive, formerly advocated by the German general staff and figuring as a dogma in most military regulations, has been substituted the defensive-offensive. The tactician has resigned himself to the organization of a position whose immense development denies the enemy all routes of invasion or permits the progressive recoil of its military frontier. He has been obliged to submit to the combat methods reserved for sieges, and the slow progression of works of approach. To-day, a maneuver-battle is the exception.

The determining cause of this evolution in modern warfare must be sought in the improvements in armament and explosives. There has resulted a notable increase in the efficacy of fire. Hence, the importance of a scientific determination of the deadly and destructive effects of projectiles. The first, destined to eliminate living targets, are obtained by rifle and shrapnel bullets, as well as by field gun shells; the second are the consequence of the explosion of shells of medium and large caliber, whose object is the destruction of the covering mass and of the obstacles, altho their dynamic action takes effect also on the garrison.

II. *Notions of Exterior Ballistics*

Towards the end of the 16th century, Galileo established the first equation of the trajectory in its simplest form. He demonstrated that a body, thrown freely into space, describes a parabola with a vertical axis. The physical properties of gases being unknown at that time, he neglected the retarding effect of the air. As is well-known, the parabolic movement applies only to the ideal case of the vacuum. It is proper to take account not only of the acceleration due to the weight but also of the resistance of the air, which, according to Newton, would be proportional to the right section of the projectile, to the square of its velocity, and to the density of the fluid. This principle, accepted for a long time, gives sufficiently exact results only when the initial velocity is inferior to 240 m. a second, or superior to 420 m. a second. Our compatriots, Evler and Jean Bernouilli, of Basle, taking up the work of their predecessors, opened the way to the illustrious geometricians, Borda, Gauss, Cauchy, Piobert, who laid the foundations of a new science of dynamics.

PROJECTILES—Continued

The principal consequences of atmospheric action are:

1°. The angle of departure is always smaller then the angle of fall.

2°. The tangential speed and the radius of curvature are greater in the ascending branch than in the descending branch.

3°. The abscissa of the summit of the trajectory is greater than one-half the range.

The rotation of the bullet is favorable to penetration and diminishes the consumption of kinetic energy. However, the rifle bullet, on account of its relatively small weight, has a tendency to wobble about its center of gravity; to reduce this tendency the ogival profile has been recently adopted. The shrapnel bullet has to maintain its velocity as a separate body only from the point of burst, or hardly more than 150 meters in any case. It then retains the spherical form formerly used for all projectiles, until the appearance of the Dreyse needle-rifle (1841) and of rifled artillery (1859). In order to estimate the dynamic action of bullets and fragments, whose penetration diminishes in direct ratio to the range and the medium passed thru, we must evidently have recourse to the principle of kinetic energy, the well-known equation of which is

$$W = \frac{mV^2}{2}$$

III. *Stopping Action of Bullets and Shell Fragments*

The irregular fragmentation of the shell does not lend itself to the calculation of the remaining energy of its fragments, so we shall examine more particularly the dynamic action of rifle and shrapnel bullets. An examination of the energy equation shows that, to an increase in velocity, may correspond a considerable diminution in the weight of projectiles. The air then has a lesser retarding effect. This improvement has been realized by the substitution of chemical explosives for mechanical explosives. In fact, the invention of powders with a base of nitro-cellulose (pure or mixed with nitroglycerine), due to the French engineer Vieille, gave initial velocities such that the effective range was about doubled (800-1000 meters for infantry, 4-5 km. for field artillery). The result was a transformation in armament which took place from 1886 to 1892 for small arms, while economic reasons or the mechanical improvements necessary caused the creation of new artillery matériel to be deferred until about 1897.

To Vieille belongs the honor of having found the first really stable ballistic explosive, produced by the gelatinization of the gun-cotton discovered in 1846 by the chemist Schoenbein (of Basle) by dissolving cellulose-cotton in sulpho-nitric acid.

In order to diminish the deformation, caused by the heat produced when the projectile strikes the objective, the hardened lead, containing 2.10% of antimony, was covered with an envelope of hard metal, copper, nickeled steel or "maillechort" (alloy of 50 parts copper, 25 of nickel and 25 of zinc). This indeformable sheath increases the penetration in hard bodies but diminishes the spreading of the projectile and consequently, its surface of attack. The latter is relatively small, since the largest caliber bullet now in use has a cross-section of only 0.5 cm^2. With the ogival profile the energy at the muzzle was increased from 300 kgm. to 350 kgm. At the characteristic battle distances, the remaining kinetic energy is still sufficient to produce serious lesions. In fact, *W* reaches 65-70 kgm. for a range of 800 meters and is not less than 20 kgm. for 2000 meters (remaining velocity 250 meters a second).

At the point of burst, in effective artillery range, a shrapnel bullet has a remaining velocity of 350-520 meters a second and, at 150-200 meters farther on, of 180 meters a second. It has remaining energy enough to put a man out of action, 15 kgm. per cm^2 of section (for the horse 30 kgm. per cm^2 is needed). The spherical form of the bullet is justified not only for economic reasons but also on account of the uncertainty of its direction from the point of burst and the short distance it has to go.

All the medium caliber pieces of the siege parks (Rimailho 155 long), as well as the majority of the light and heavy howitzers (Rimailho 155 short, French short 120 cannon) fire shrapnel much more powerful than those of the field gun; they contain 250-500 bullets weighing 20-65 gr., as against 300 bullets of 9-13 grams.

So far, we have considered the deadly effects of the bullet apart from its action on the organ struck. Evidently, the greater or less gravity of the lesions is not entirely dependent on the energy of the shock. According to Colonel Bircher, Swiss Sanitary Service, the human body comprises three vulnerable zones which are the seat of mortal, serious and slight wounds. The extent of these zones is in the proportion of 25, 15, and 60 for the rifle bullet. For the shrapnel bullet, the proportion is mortal 30, serious 25, and slight 60.

The concentrated energy and the metallic envelope of rifle bullets facilitate their penetration in hard bodies, such as bones, artillery and embrasure shields. Shrapnel bullets cause more serious tears in the soft parts of the body, on account of their great surface of attack and the mushrooming of the hardened leads, but have the disadvantage of striking the objective with a much lower remaining energy.

Small caliber explosive projectiles belong to two characteristically different types. The French 75 shell has thin walls and a strong charge (825 grams of mélinite); it breaks up into about 2000 very small fragments, animated by an initial velocity close to 1200 meters a second. The German 77 with thick walls and small charge (135 grams of picric acid) projects at the point of bursting about 500 fragments, whose weight is very variable (10-200 grams) and whose velocity is relatively low (300-400 meters a second).

Shell fragments are capable of causing very serious tears in the tissues of the human body, on account

of the irregularity of their form, their great surface of attack or the kinetic energy developed by the explosion of high explosives (mélinite, lyddite, écrasite, emmensite, shimose). These different varieties of explosives have a base of picric acid produced by the nitrification of phenol. To-day, they are sometimes replaced by trotyl.

The French 75 shell produces not only the dreaded "ax-blow" but also the "breath effect," or violent expansion of the gases disengaged by the combustion of the powder, when the explosion takes place in an enclosed space. It is then capable of destroying a house or a combat shelter and causes in man, up to 4 meters from its point of burst, internal hemorrhages always mortal.

After having considered the projectile alone, we shall study the different classes of deadly effects produced by the sheaf of fire; its efficacy is subordinated to the dispersion of the arm, to the conduct of the fire and to the declivity of the terrain.

(To be continued.)

PROMOTION

See also

Officers—Promotion of

—Non-Commissioned Officers

[Emergency Commissions for Non-Coms. *Army & Navy Jour.*, Mar 17, '17. 700 words.]

The plan to list experienced non-commissioned officers of the United States Army who, in the opinion of their regimental commanders, are eligible for emergency commissions has met with unanimous approval in the service. It is recognized that these non-commissioned officers are excellent material for company officers. Also, the plan should aid materially the recruiting for the army.

—Officers

[Study of a Law for Promotion. By Maj. Charpin. *General Staff Pamphlet*, published in Santiago de Chile, 1917. 14,000 words.]

After an exhaustive study of this subject, the writer concludes that the basis of a law for promotion should be correct classification and selection of officers. With this as a basis, a promotion law becomes a simple regulation which functions so that promotion is regular and sure to those worthy of it, and elimination is no less sure for those found unworthy. Any law of this kind would be a failure if it did not provide for sure promotion to the higher grades for good officers before they reached the age of retirement; for voluntary retirement after a certain number of years of service, and compulsory retirement for age, to the end that the higher command may be fit to exercise active command both in peace and in war.

The following points are thought to be fundamental in the consideration of a law for promotion:

1. The annual classification made in conformity to the regulations should serve as a basis for the selection, promotion and elimination of officers. All Majors and higher Commanders should take into consideration the capacity and ability of subordinates with a view to classifying them according to their merits.

2. Graduates of the military academies only, should be appointed as Sub-Lieutenants.

3. Each officer should have a minimum period of service in each grade as follows, to pass from Sub-Lieutenant to General of Division.

3 years as a Sub-Lieutenant
4 years as a Lieutenant
5 years as a Captain
4 years as a Major
4 years as a Lieutenant Colonel
4 years as a Colonel
2 years as a Brigadier General

4. As a requisite to ascend to the grade of General of Division there should be required a minimum service in each grade of two years in Command of the unit to which the rank of the officer corresponds.

5. Service at the Military Academies and at Schools of Application should count as Army service.

6. Officers who have served for a year after graduating from the Military Academy should not be permitted to transfer from one arm to another without having satisfactorily passed the examination required for promotion to the grade of Captain.

7. No officers above the grade of Captain should be transferred from one arm to another.

8. Pending the organization of the different schools of application proposed by the organic act of the Army, there should be established as a requisite for promotion to the grade of Lieutenant a practical and theoretical examination in conformity with regulations established by the Supreme Government.

9. There should be an annual revision of the list of officers for the purpose of selecting officers both for promotion and for elimination.

10. The list of Subaltern Officers and Captains should be revised annually by the Merit Commission of the Personnel Department acting jointly for this purpose with the Directors of the Military Academy; the lists of officers to be eliminated and to be promoted for merit to be formed immediately, in the proportion indicated later in Articles 13 and 14.

11. The revision and formation of lists of officers above the grade of Captain should be made by the Board of General Officers charged with the annual revision of qualifications.

12. To facilitate the work of the Revising Boards, and to render comparison more easy, the Personnel Department will make annually charts showing grade, arm and seniority of all the officers of the Army on which will be shown the comparative development of the military career of the officers and in which will figure the notes obtained upon graduation from the Military Academy, during the courses of Application and courses at the War College, examinations for promotion, qualifications in each grade, punishments imposed, important distinctions conferred, professional preparation, and the works or publications contributed for the betterment of the Military Service and the progress of the Army.

PROMOTION—Continued

13. With the last qualification in view and also the chart referred to in Article 12 as a guide, both Commissions will propose for elimination the following officers: two Colonels, four Lieutenant-Colonels, four Majors, four Captains and four Lieutenants; a total of eighteen officers. (Note: This figure represents scarcely the third part of the voluntary retirements occasioned annually by stagnation in the lower grades. Between 1904 and 1914 four hundred and sixteen officers retired for this cause.)

14. If there should not be enough individuals of the second series on the charts to complete the quota, it will be completed by the elimination of the least meritorious individuals of the first series, this after a careful comparison of the merits of individual officers of each grade on the list.

15. Both Commissions will proceed in the same manner to form a list for promotion by selection, the following quota being filled.

Lieutenant Colonels	2
Majors	6
Captains	10
Lieutenants	14
Sub-Lieutenants	18

16. Sub-Lieutenants will be promoted by seniority to the eighteen vacancies in the grade of Lieutenant.

17. Officers will rank by seniority in grade according to the date of entrance and order in the list of selections.

18. Those who have last qualified will be placed at the foot of the list.

19. Those who failed at one time to qualify for promotion by selection and who later qualify will be placed at the foot of the list.

20. Those who, because they have not the requisites for promotion, can not be qualified for promotion by selection will be placed also at the foot of the list.

21. Those who have been suspended from office or who have suffered punishment imposed by a competent tribunal will not be considered in the list for promotion for selection while remaining in the grade in which they suffered punishment.

22. Ordinary vacancies produced by death, retirement or other causes will be filled on two dates only, namely: the 18th of September and the first of April. (Note—Fifteen days after the close of Maneuvers.)

23. The pay of all posts that are not filled in the course of the year, including that of Lieutenants, because of the lack of officers, will be placed to the credit of the Fund for Retired Officers.

24. Ordinary vacancies will be filled in the following manner: Higher Officers; two-thirds by selection, one-third by seniority; Captains, one-half by selection, one-half by seniority. Subaltern Officers; one-third by selection, two-thirds by seniority.

25. Generals of Brigade and of Division who have completed six years in their respective grade, or who have had forty years of service, may retire on full pay.

26. Officers who have completed thirty years of service may ask for retirement, with the proviso that they in each case must have served in their highest grade a period sufficient for promotion. Retired pay will be based upon full pay, allowing the fortieth part of the latter for each year's service.

27. Officers who have completed forty years of service and who possess requisite qualifications for promotion will have the right to retire with promotion to the next higher grade.

28. Officers who are eliminated or who retire voluntarily will be placed on a list for passive service. They will not be entitled to promotion but may be placed on duty as follows: Post Commanders; Recruiting Service; Inspectors of small-arms practice; Service in the Territorial Guards; Coast Guard duty; Military Store-keepers; Military shop and store-houses, powder magazines, arsenals, etc.

29. Subaltern Officers and Captains who have been eliminated or who retire voluntarily may enter the Military Administration Service in a position corresponding to the grade held; this after an examination for competence.

30. Service in the posts mentioned in the two preceding Articles gives the right to retire with a pension of the fortieth part of full pay for each year of service. In no case can this pension exceed the pay corresponding to the grade.

31. Officers who have retired voluntarily may not be reinstated after they have been out of the service for a year. In any case the absence from the colors will not be included in computing seniority and time for retirement.

32. Officers absent on duty with a foreign government make a vacancy on the list at the end of three years and six months of absence.

33. Officers who serve in Copiapo and the South of Chile will, in computing time for retirement, be given a credit of one additional year for each two that they served in said localities. The total credit may not exceed five years.

34. Officers of the General Staff who have served in the Great General Staff: the General Staff of Troops, Ministry of War, or General Inspection of the Army, are entitled to a credit with reference to their retirement of six months for each year of such service.

35. Officers of the Adjutant General's Department, provided that they have completed a regular course from Battalion Adjutant upwards or have completed satisfactorily the second year's course at the War College are entitled to a credit with reference to retirement of one year for each three that they have served as Adjutants of Regiments, Brigades or Divisions. The total credit may not exceed two years.

36. When by reason of inequality of vacancies in the different Arms, an officer of less seniority on the selective list is promoted, his seniors of the other Arms on said list of selection recover their seniority upon promotion.

37. Those who are promoted by reason of seniority will not have the right to recover seniority nor will they be placed above an officer promoted by selection.

38. It will be established as a principle that no officer will be detailed to the General Staff who has not completed satisfactorily the third year's course at the War College and who has not survived the test of a provisional appointment for at least one year on the General Staff.

[An Aspect of the Question of Promotion. By Maj. Charpin. *Memorial del Ejército de Chile,* Aug, '17. 1100 words.]

"In an Army that has functioned normally for many years, individuals of the Corps of Officers begin their military careers at about the age of twenty. The development of the career under good conditions brings the Cadet after forty years of service to the highest grades of military hierarchy. Officers arriving at the age of sixty, for various reasons usually are compelled to withdraw from active service, thus producing annually a series of vacancies which maintain a regular flow of promotion in all the inferior grades, even when there are no elimination laws in force.

In the Chilean Army the circumstances were such that after 1891 many officers, in fact the majority, obtained in one year the grades that normally would take about twenty years or more of service to reach; and in consequence in the list of 1892 there were Majors of eighteen years of age and Generals of thirty. This has resulted in the presence in the Army to-day of Subalterns of advanced age and a decided stagnation in the flow of promotion in the lower grades.

The only remedy is the passage of a promotion law that will regulate definitely the military career of each officer; that will give to each one according to his services the security of regular promotion or of sure elimination. In this way only can be brought about the best development of the Corps of Officers and the greatest efficiency in the performance of duties pertaining to National Defense."

PROPELLERS

See

AERONAUTICS—MANUFACTURE OF AIRPLANES—PROPELLERS

PROVING GROUNDS

See

AERONAUTICS—PROVING GROUNDS
ORDNANCE—PROVING GROUNDS

PRZEMYSL

—First Siege of

[Przemysl. By L. of Petersens. *Tidskrift i Fortifikation.* Parts 5 and 6, 1916. 7500 words, 12 illustrations and 1 map.]

The name Przemysl will take its place in the history of sieges beside those of Belfort, Port Arthur and Adrianople. No other fortress has played nearly as great a part, with respect to fortress warfare, during this world-war.

The Strategical Importance of the Fortress

The Austrian frontier toward Russia has no strategical system of fortifications like those of most of the frontiers of the European countries. The boundary between Austria and Russia passes thru a plain with no natural boundary line. The Carpathian mountains, which are the natural barriers, lie too far back and are on account of their condition naturally easy of defense. On account of these conditions only two larger fortresses have been built in Galicia, Cracow and Przemysl. These are not situated in strategic positions with respect to each other, but are only two great supply fortresses that under certain circumstances can be used to stop the advance of an enemy. Przemysl owes its strategic importance to its being the point of support of the important San River line, and it was probably chosen instead of Jaroslav because the important doubletrack Cracow-Lemberg railway line crosses the San River here. It has also since the earliest times been fortified and during several centuries it has in vain been attacked by Tartars, Cossacks, Swedes and Transylvanians, and not until it was starved out on Mar 22, 1915, had it fallen.

The Character of the Fortress

During the time that the relations between Russia and Austria were friendly the fortress had less importance, but after these countries had become rivals for influence in the Balkan peninsula, it became more important and during the 1880 decade it was enlarged and designed as a large encampment fortress. After the invention of high explosive shells in 1890 it was rebuilt with a view to protection against these. The fortress can be classed among the largest, having a circumference of about 50 km.; it consisted, when besieged, of an *enceinte* and a surrounding *line of forts.*

The *enceinte* consisted of a simple wall of earth with a line of obstacles in front of it. At certain points in this line there were constructed independent works for flanking the spaces between the outer forts. The principal outer forts, 14 in number, are the same which were built in the 1880 decade, partly reconstructed later. They are lunette-shaped with a ditch, brick counterscarp and a scarp wall with a slope equal to that which the earth will naturally assume. The glacis, as well as the scarp slope were supplied with wide barbwire entanglements. The forts were open to the rear and had no means of firing in that direction. The ditches were flanked in places by small caponiers. To prevent an assault of the forts from the rear they seem to have depended on casemated batteries on the flanks.

The armor for the turret guns was of the best material manufactured at the Skoda factory. It seems that these turrets remained uninjured during the Russian bombardment of the fortress, not one of them having been put out of commission, but they were blown up by the Austrians before the surrender.

Przemysl's First Siege

After the battle at Lemberg, Sept 2, 1914, and the battle at Grodek, Sept 7-9, the Austrians were obliged to retire behind the San, with their right flank resting on Przemysl. They could not however retain this position owing to the continued pressure of the Russians and had to retire and leave the fortress to defend

PRZEMYSL, First Siege of—Continued

itself. The commandant was Lt. Field Marshal von Kuzmanek, with Col. Schwalb as fortification commander. The garrison during the first siege was not unusually large and consisted of Hungarian landwehr regiments of excellent quality, reinforced by troops of different kinds such as volunteer Galician Jews, which had shown themselves reliable in previous battles, landsturm, etc. Among the artillery of the defense were found several (one report says 4) of the Austrian 30.5 cm. mortars which proved a very valuable addition to the defense.

All means were taken to prepare for an energetic defense. The area of fire was cleared for quite a distance around it, by cutting down the woods, by putting up obstructions of all kinds such as abattis, barb-wire entanglements, wolf-pits, mines, etc. Railway tracks were laid for the heavy guns and mortars of the mobile artillery so they could be readily moved to defend threatened points.

Sept 22, the fortress was completely invested but this did not prevent the garrison from being in uninterrupted communication by means of its wireless telegraph with the Austrian headquarters as well as with the radio stations at Nauen and Nordeich. In addition to this communications were kept up by aircraft in spite of the lively Russian fire against them. The morale of the garrison was excellent during the whole siege and they did not suffer from lack of food or drink, except milk, butter, cigars and matches which became scarce before the siege ended.

The besieging army consisted of about 200,000 men under the command of Gen. Radko Dimitriew. Beside their numerous field artillery the Russians had 15, 18, 21 and 24 cm. pieces and some naval guns brought from their Black Sea fleet. Owing to the continuous rains and the miry roads it was very difficult to bring up and place in position these heavy guns, but the bringing up was made possible by relaying the railway tracks to Russian width of track so that they could use their own rolling stock on them. The defenders did everything to hinder the artillery of the besiegers from being brought up, both by fire from the forts and by powerful sorties when both prisoners and guns were captured, which made it more difficult for the Russians to prosecute the bombardment. Altho the fire of the besiegers was well directed and many hits were made yet the damage was slight owing to the resistance offered by the armor and concrete constructions.

After the Germans and Austrians successfully began their offensive operations in October Gen. Dimitriew received orders from both Archduke Nicholas and the Czar to capture the fortress at all costs. On Oct 4-7, the artillery fire was increased to its utmost intensity and the assaults were made with a recklessness that can well be compared with anything that the Japanese did at Port Arthur. Besides the guns that were mounted in the different forts, the Austrians had numerous batteries in the spaces between them and the 30.5 cm. mortars also showed their value as they could be transported readily to the places where they were needed, and wherever they took part they were able to silence the Russian batteries being more powerful than any one of these. During three days continuous assaults were made but without success. Column after column was sent forward but all were mowed down by cannon and small arms fire. Only in one instance did any of them succeed in entering one of the forts. It was when a searchlight had been damaged so that there resulted a dark sector and thru this a detachment succeeded in gaining entrance to the fort. There then took place a most fearful combat in the galleries of the fort which finally ended by all the assaulting detachment being exterminated. According to the latest reports the Russians lost about 80,000 men in these assaults.

Przemysl's Second Siege

The Central Powers in their October offensive succeeded in driving back the Russians beyond the fortress, thus relieving the latter, but only about a day's march and then they met with such a stubborn resistance that they had to halt, and four weeks later retire and again give up the San River line, leaving in Przemysl a great many wounded and sick whom they had not been able to send back to the rear owing to the condition of the roads. On Nov 11, the fortress was a second time invested by the Russians. The commandant was still General Kuzmanek and his second in command was von Tamassy, chief of the Hungarian landwehr division No. 23, who afterwards personally led the sorties. Besides the above named division, which constituted the flower of the garrison, it also consisted of landwehr from East Galicia, landsturm from Galicia, Upper and Lower Austria, fortress artillery, sharp-shooters from the Tyrol, a regiment of hussars and many technical troops, in all considerably more men than the normal garrison.

The defense during the second siege was conducted in the same energetic manner as the first one. Sorties were frequently made well beyond the outer defense line to keep the enemy at a distance and these were often successful. They were especially made toward the southwest to endeavor to connect with the relief force that was expected from this direction, but they were also made in other directions as favorable opportunities for offensive strokes offered. The most important of these sorties was made on Dec 12, with a force of nine regiments and powerful artillery to endeavor to connect with an approaching relief force. This sortie was at first successful; proceeding 15 kilometers southwest, they almost connected with the relief force, when the Russians successfully attacked their flank and rear and almost cut them off from the fortress. In the meantime the Russians made a furious assault on the fortress but were driven back with great losses. After this, very few sorties were made by the exhausted garrison and the Russians on their part did not undertake any assaults but contented themselves with establishing their lines far enough back where they could not be seriously harassed by the fortress artillery and in comfort awaited the time when the supply of food should be exhausted in the fortress. No systematic bombardment was made by the Rus-

sians for as soon as they were able to locate a battery in an advantageous position for this purpose, the Austrian airmen would discover and locate it and a few shots from the 30.5 cm. mortars would be enough to silence it.

The fortress remained in constant communication with the outside world by means of its wireless telegraph, which functioned to the very last day of the siege, and by its aircraft which not only carried mail but also brought in valuable medical supplies.

The Russians did all they could to prevent this important air service and no fewer than 12 flying machines were destroyed and 7 reconnoitering machines with their officers were either captured or destroyed.

Even as early as December, the shortage of provisions began to be felt and horseflesh began to be issued. It was ascertained that if full rations were issued the supply would last only to the end of January and therefore reduced amounts were served out. Everything edible was made use of. The horses of the cavalry, artillery and transport service were gradually slaughtered. Sickness increased and the hospital became filled so that half the garrison became unfit for duty, yet the discipline continued excellent and even the civil portion of the garrison, reaching some 15,000 persons, showed themselves steadfast and do not seem to have added to the difficulties of the commandant. Toward the last 200 men died daily from exhaustion and 28,000 were in the hospitals.

Under these circumstances the commandant decided to attempt to fight his way out. On the evening of Mar 18, with a force of about 20,000 men, he sallied out and for seven hours battled with the Russians but was at last driven back with a loss of 6000 killed and 107 officers and 3400 men taken prisoners. The Russians attempted to follow up this success by storming the fortress, but even then in their weakened condition the defenders were able to repel the assault. The assaults were continued on the night of Mar 21-22, and realizing the hopelessness of continuing the defense Gen. von Kuzmanek decided to blow up and demolish the fortifications as much as possible and destroy the guns before giving up. This was done and not much more than heaps of ruins remained when the fortress finally surrendered. All modern larger guns including the famous 30.5 cm. were blown up. The numbers surrendered according to the Russian report, which quite closely corresponds to that of the Austrians, were 9 general officers, 93 higher grade officers, 2500 officers and officials and 117,000 men (which included workmen). The garrison was well treated by the Russians, who admired their gallant defense, and the men were not sent to Siberia but interned in European Russia.

Przemysl's Capture by the Central Powers

After the defeat of the Russians by Mackensen, the Germans and Austrians on May 24 appeared before the fortress and on the 30th the bombardment began followed by the infantry assault. Very heavy guns had been brought up including the 42 cm. howitzers, 30.5 cm. mortars, and 12 and 15 cm. long guns. In the interval between their capture of the fortress and Mackensen's appearance before it, the Russians had done what they could to put it in a defensive condition. It seems they were at first undecided whether to defend it now or abandon it without a contest, but finally they concluded to defend it as well as they could.

Owing to the damaged condition of the forts, which the Russians had not had time or means to repair, and the unusually heavy artillery that the Germans and Austrians brought up against it, the defense was hopeless from the start. After a four days' bombardment and fierce assaults, the fortress on June 2 again fell into the hands of the Central Powers.

The Fortress of the Future

No one disputes the necessity for fortifications, and in the future as well as in the past important points such as railway centers and important river crossings must be fortified in time of peace. Some have come to the peculiar conclusion that only field fortifications are now worth anything and that permanent fortifications are worthless. They have arrived at this conclusion from the simple fact that certain permanent fortifications have easily fallen under the German attacks, while certain field fortifications have held out. They have not taken into consideration that the successful defense of a fortification depends on the garrison as well as on the armament and that we can assume that the stronger the fortification is, the weaker the garrison may be allowed to be, and the reverse. That certain field fortifications have developed so great resisting power depends rather on the fact that the two opposing forces have been nearly equal and not that field fortifications in themselves possess greater strength than permanent fortifications.

The modern fortress will continue to consist of an *enceinte*, with a principal outer defensive line of forts far enough in front of this to protect it from distant bombardment by the enemy's larger guns. This outer line must also have its forts situated in a defensive relation with respect to each other, and also be connected by minor trenches to prevent an enemy from penetrating the line between the forts. This is especially necessary since attacks are now often made at night. Even with the most complete system of searchlights, unless there is a continuous trench between the forts, the penetration of the line by larger or smaller bodies of the enemy cannot be prevented. An example of this is Liége. In planning the principal defensive line, it should, as in the case of field fortifications, consist of several lines, one behind the other. The first of these is used principally as an observation line. The resulting network of trenches and pits should be most carefully masked and this can better be done in permanent than in temporary fortifications since time is given for grass and shrubbery to grow over the parapets and thus render them less conspicuous. In the trenches are also constructed many shelters of different kinds, some of them bombproofed to resist the heaviest artillery. Strong *points of support* should also be located at important points from which counter-attacks can be made on troops that have broken thru the front line. Traditor batteries (casemated batteries in the gorge or on the flank of a work) will also

PRZEMYSL—Continued

continue to play an important rôle. Obstacles will consist principally of barb-wire entanglements and the wire should be heavy so that it cannot be easily cut and should be securely fastened to iron posts. These obstacles should be put in trenches so as not only *not* to obstruct one's own fire but so that they cannot be readily destroyed by the enemy's fire.

The normal garrison for a fortress should be about one man per meter of the circumference.

—Second Siege of

See also

PRZEMYSL, FIRST SIEGE OF

PUMPS

—Trench

[A Steam Pumping Plant for the British Trenches. *Scientific American,* June 2 '17. 220 words. Illustrated.]

To keep the trenches free of water, many types of pumps are employed, ranging from the simple hand-pump to the elaborate power-driven pump. The British are using a new steam pumping outfit built in the United States. This outfit works in conjunction with a pulsometer steam pump. The power plant makes use of a standard steam-automobile 14-inch boiler, and is supplied with steam gauge, safety valve, automatic fuel control valve, a steam pump for pumping water from the tank into the boiler, and a regular burner. The tank unit is supplied with a five-gallon tank, a three-gallon fuel tank, two fuel pressure tanks, and water and hand fuel pumps.

QUARTERS

See

BARRACKS

QUEBEC, Capture of

[The Quebec Campaign of 1759. By Major Robert E. Wyllie, C.A.C. *Jour. Mil. Service Institution,* July-Aug, '17. 7000 words. Two maps.]

(Historical. A thoro and critical study of this campaign. To be continued.)

RADIO-ACTIVITY

[Points on the Radio-Activity of Matter. By Raul Barrera. *Rev. del Circulo Militar,* Sept, '16. 4000 words.]

(A non-military article setting forth in simple terms the modern view of radio-activity; explaining its manifestations, phosphorescence, fluorescence, cathode rays, etc., and its value to the scientific and commercial world.

Published for the benefit of young officers and others located at isolated stations where books on the subject might be difficult to obtain.)

RADIO COMMUNICATION

See

WIRELESS TELEGRAPHY

RAIDS

[Description of a Trench Raid. By Our Special Correspondent. *Infantry Jour.,* June, '17. 1700 words. 1 map.]

An enterprise of this nature, called a *coup de main,* is for the purpose of obtaining prisoners. The French General Headquarters keeps a record of the dispositions of all German organizations, and this raid was ordered for the purpose of ascertaining what German regiment was in a particular front.

The plan was submitted to the division commander by one of his regimental commanders and provided for a sudden, terrific bombardment on a small salient in the German trenches, its complete isolation from rear and flanks by continuous curtain fire, and the sending forward of a detachment of 90 men to seek prisoners in the salient.

From aerial photographs, trenches identical with those to be attacked were constructed in rear of the French line, and the detachment was drilled there daily, each man in the duty he was to be required to perform.

The French trench mortars were to make two breaches, about 50 yards apart, in the German wire entanglements, thru which the detachment was to enter and operate back to the German second line, thru communicating trenches in rear of the breaches. The detachment was divided into four groups whose orders were as follows:

(a) The first group, 1 officer and 18 men, to advance along the left communicating trench, with flankers to their left to bar trenches in that direction.

(b) The second group, 2 officers and 37 men, to advance along right communicating trench, cleaning out, for a distance of 60 meters, all trenches running to their right.

(c) The third group, 1 officer and 16 men, to clean trenches between the right and left groups, to connect them, and to cover their return.

(d) The fourth group, 1 officer and 16 men, to remain in French first line as a support. With them was the captain who had orders to send up a rocket signal for all his men to return, as soon as any prisoners were brought in.

Artillery

Six trench cannon were placed directly opposite each of the points to be breached, 250 to 400 yards distant. These were 58 mm. pieces, firing a winged projectile carrying 40 kilos of high explosive. Their duty was to make the breaches.

Six batteries of 75 mm. guns and 3 batteries of 155 mm. guns were to form the curtain of fire.

There was one airplane to regulate artillery fire, and one to keep the division commander in the rear informed as to progress made, and to carry any orders he might transmit.

The Operation

The men were lined up in the front line trench, distant 35 to 50 yards from the German first line, each armed with an automatic pistol, ten hand grenades, and each group with two smoke grenades to hide their

movements when returning. Each man wore a white arm band and carried no papers or marking which could give information to the enemy.

The observing officer was posted in a firing trench, on high ground giving a good view of the ground in front where the operation was to take place, some 350 yards distant. Here also was the captain of the trench mortars, the lieutenant in charge of the telephone system, and the first aid station. The regimental commander was in a dugout close by, connected with the different commanders by telephone.

At 3:40 p. m., the trench mortars opened on the wire entanglements; the 75's dropped a curtain of fire around the sides and rear of the salient; the 155's fired at battery and machine gun emplacements.

The Germans had no intimation of what was coming. They replied with their artillery, but not actively, and did not locate the trench mortars. Several times shells cut the telephone connection with the mortars, but each time men ran out and repaired it.

At 4:40, it was seen that the two breaches had been made, and at 5:10 the fire of the mortars was shifted to the front line trench, well to the flanks, where fire was continued thruout the attack.

The detachment was permitted to attack at any time after 5:20, at which time, the curtain of fire was moved outward about 150 yards, surrounding the salient, percussion shrapnel being used.

At 5:22 the men advanced at a fast walk or double time, and found in the front trench three unwounded prisoners whom they brought back. The captain immediately sent up the rocket to recall his men, this at 5:28, and all were back at 5:32. At 5:35 another rocket announced to the artillery that all the detachment had returned.

Counter Operations

At 5:25, the Germans sent up a rocket signal for barrage which came at 5:32, when all but two Frenchmen had returned. At the first salvo, the two threw themselves flat, then jumped up and ran in. The barrage was quite heavy, lasting for one hour, the projectiles being 150 mm. shells.

The French artillery expended 9242 shells. The operation was considered successful as the desired information was obtained from the prisoners.

The division commander's report contained the following conclusions:

1. That eight days' special training is needed for a *coup de main.*

2. That perfect liaison between infantry, artillery and aviation is essential.

3. That it is difficult to take prisoners from a dugout in such a quick operation.

4. That machine guns should be placed well to the flanks of the position, so they will not become involved in the counter bombardment.

5. That the men should have gas masks hung around their necks.

6. That operations of this nature greatly improve the morale of the men.

—Aeronautic

[Air Raids. Editorial. *Army & Navy Gazette* (London), Sept 9, '16. 1200 words.]

Damage done by the many air raids made upon this country has been insignificant and it is believed that the infliction of military damage was not their object. They expected to create a panic which would act in two ways, either lead to a general desire for peace, or the inhabitants of the British Isles would clamor for additional protection, thus diverting forces from the field, weakening our lines in France and Flanders. There were signs at one time that the stay-at-homes were becoming over-anxious about their protection, but these hysterical times have happily gone by. The raids, tho more frequent, have become less important. The raid carried out on the night of Sept 2-3 was the most formidable yet attempted. Thirteen airships, some doubtless of the latest pattern, took part. Some loss of life but no military damage resulted.

The material effect of these raids is becoming less and less, and the moral effect has dropped to zero. When a raid is signalled the crowds flock into the streets.

In something like thirty-six raids, less than twelve hundred casualties have resulted. The moral effect upon us is entirely lost. Can it be that they are continued purely for the moral effect at home?

[An Aerial Raid. By Sub-Lt. Pico. *Revista Militar,* Oct, '16. 2100 words.]

(This is an account of a flight made in an aeroplane of the Blériot type with a 50 h.p. Gnome motor, from El Palomar to Monte and Ensenada and back to El Palomar.

Despite motor troubles and unfavorable weather conditions, the flight, including three stops, was successfully made between the hours of 6:35 a. m. and 2:45 p. m. The distance traveled is not given.)

—Aeronautic—Defense Against

[The Strafing of Germany's Zeppelin Fleet. *Sphere,* Dec 9, '16. 400 words. Illustrated. Three tables.]

(The attempt has been made to make a reliable list of the Zeppelins destroyed to the end of November, 1916. A list of those destroyed each calendar year is given. In 1914, seven were destroyed, of which four were brought down in Allied territory, and three were destroyed by attacks on sheds in German territory. In 1915, nine Zeppelins and seven other dirigibles were destroyed. Of these, apparently ten were brought down in Allied territory or at sea. To Nov 28, 1916, fourteen airships were brought down, of which twelve were identified as Zeppelins. Of these, eleven were brought down on Allied territory or at sea.)

—Trench

[German Raid on British Trenches. Translated from captured German documents. *Infantry Jour.,* Sept, '17. 10,000 words. 4 sketches. 3 tables.]

The article includes the regimental orders for a raid, which took place on the British trenches near La Boisselle, Apr 11, 1916, the special orders issued by the commander of the raiding party, a table for

RAIDS—Continued

the distribution of the artillery fire to support the raid, and special orders for a feint attack and a feint bombardment. The regimental report on the execution of the raid, including the feint attack and bombardment, and the report of the commander of the raiding party are given.

The preparation for this raid began on Apr 5th with the registration of batteries assigned and then in position. The raiding party consisted of six officers, one surgeon, one bugler, six stretcher bearers, fifty infantrymen and four pioneers. Three patrols of one officer and ten men were organized, with the remainder of the party held as a support. These patrols were to pierce the first-line British trenches and then return with what prisoners and booty they might be able to take. All men were equipped with gas masks and each wore as a distinguishing mark a white triangle of linen sewed on the breast and back. The men of the patrols were equipped half and half with pistols and rifles. Dummies were displayed by the Germans during the feint attack immediately after the firing of a mine.

From the German reports on the raid it was highly successful. The gas shells had completely confused and paralysed the British. The wire at the point of entry had been so completely destroyed on a width of 44 yards by 14 heavy and 70 medium *Minenwerfer* shells that the raiding party did not notice when they crossed the wire entanglement. The capture of 20 unwounded and 5 wounded prisoners, 1 Lewis gun, 21 rifles and other plunder was reported. It was claimed that only one man of the raiding party was slightly wounded.

The German deductions from this raid were (1) that much of the success was due to the use of gas shells; (2) that artillery with gas shells is most successful in mastering the flanking defenses; (3 that it is not well for the attackers to have their vision and breathing hampered by gas masks; (4) that when the enemy's trench has been successfully cleared for 150 to 200 yards and the enemy barrage has not opened on the point of exit, an advance to the second-line or even third-line trench could be achieved with small loss by fresh patrols; (5) and that prisoners should be examined by officers near their place of capture.

RAILROADS

See also

CHILEAN-PERUVIAN WAR—RAILROADS IN

Argentina

[National Railways. State Railways and the Engineer Troops. By Capt. Torres. *Revista Militar*, Sept, '16. 1600 words.]

The nation has expended something over 130,000,000 pesos in gold in the construction of 5500 kilometers of railways which are now in full use.

A progressive plan of construction is being carried out. The state roads, which include 18 per cent. of the entire railway system of the country, are now more than self-supporting. They should serve as a basis for the acquisition by the government of all the roads. Foreign employees should be replaced gradually by natives of Argentina.

The program of instruction for engineer troops is incomplete because funds are not available for practice in building roads, bridges, telegraph lines, railroads, etc. The technical troops could well be used in the construction of permanent works of this nature. By putting the six corps of engineers on a war footing, with reference to the personnel, and maintaining them at full strength for five or ten years, the various works now being carried on by the administration at great expense could advantageously be entrusted to them.

The benefits to the nation would be as follows: the work would be done at less expense and more efficiently, and a body of trained specialists would be secured who upon completion of their service with the colors would be on hand to compete with the generally undisciplined and incompetent contract laborers. The measure advocated would tend also to popularize the army and to kill the germs of anti-militarism usually to be found in cosmopolitan centers like the cities of Argentina.

(Here follow observations with reference to the economic and strategic advantages that would accrue from the construction of certain railway lines thru various localities.)

[National Railways. By Capt. Torres. *Revista Militar*, Oct, '16. 2500 words. 1 map (continuation).]

The discussion of the strategic value of certain railway branches is continued. The lack of transversal lines uniting the extreme frontiers is commented upon. Attention is called to the almost insuperable difficulty of effecting a general mobilization when, as is the case here, the general staff has had no practical experience in this work and railway officials and employees are in absolute ignorance of military affairs and needs. It is recommended that staff officers be assigned to the various lines to work out plans for increasing the military value of each.

France

[To Send Engineers to France. *Army & Navy Jour.*, May 12, '17. 1600 words.]

The War Department has ordered that nine additional regiments of engineers be raised as soon as possible for service in France on the lines of communication. The commander and the adjutant of each regiment will be selected from the Engineer Corps of the Regular Army. The remainder of the personnel will be composed of experienced railroad men and others trained for the particular work to be encountered.

[Portable Track for French Strategic Railways. From the *Iron Trade Review*, Mar 22, '17. *Jour. Franklin Institute*, June, '17. Quoted.]

The abnormal traffic of heavy motor trucks over French roads in proximity to the fighting line for more than two years has rendered them almost impassable in many places. In addition to this destructive effect, the roads, like the battlefields, have been

furrowed and plowed by bursting shells until all semblance to highway or even lane is blotched out for miles. The problem of transporting the heavy supplies of ammunition, food, and clothing over the shell-torn fields to the points of action has been greatly simplified by the use of portable track. France is approximately as large as the states of Montana and Ohio combined; the part of the country confined to actual warfare is perhaps one-tenth of this area, yet within that small section there is a network of more than 2500 miles of this narrow-gauge track.

The track is made in convenient lengths—1¼, 2½, and 5 meters—which may be readily connected to curved sections, turntables, and numerous types of switches and cross-overs. The three lengths have three, five, and eight ties, respectively. The gauge is 60 centimeters. The rails, which are rolled to a special size designated by the French Government, weigh 20 pounds per yard. The general appearance of the rail section resembles the standard A. S. C. E. section 16. The ties weigh about 20 pounds each, and withstand a bending stress of more than 4500 pounds. They are pressed hot from 3/16-inch sheet stock into a dished form, measuring 6 by 44 inches, with a ¾-inch rim. The appearance of the sections and the ease with which they may be laid remind one of the very neat toy track and train assortment now in vogue. But this track is built to withstand severe service; it is laid by experienced track layers and carries carload after carload of heavy shells and other supplies. The trains are operated by double-ended Baldwin locomotives. A large percentage of this portable track is made at the plant of the Lakewood Engineering Company, Lakewood, Ohio. At the present time the Lakewood Company is producing from three to four miles of track a day, requiring 80 to 100 tons of rails and 75 tons of tie stock. The contracts completed and active involve more than 8000 tons of this portable track.

[Our Army to Rebuild French Railways. *Army & Navy Jour.*, June 2, '17. 500 words.]

Of the nine regiments of engineers to be sent to France as soon as possible for work on French railways, there will be five construction regiments, three railway operating regiments, and one shop regiment. The regiments will contain six companies each. The commanding officers and adjutants will be officers of the Engineer Corps, U. S. Army. The commissaries will be provided by the U. S. Army. Railroad men will constitute the remainder of the personnel as follows:

In construction regiments: lieutenant-colonel, chief engineer of a railroad; captains, engineers of maintenance of way; lieutenants, supervisors oi roadmasters; non-commissioned officers, track and bridge foreman; privates, 150 track laborers and 14 bridge carpenters to each company.

In the shop regiment: lieutenant-colonel, superintendent of motive power; captains, master mechanics; lieutenants, shop foreman; non-commissioned officers, gang foremen; privates, boilermakers, machinists, blacksmiths and their helpers.

Each of the operating regiments will be a complete railroad operating unit in which the lieutenant-colonel will be a general manager or a general superintendent of a railroad.

Germany

[B. B. B. B. B. B. *Independent*, Jan 15, '17. 1100 words.]

What Herr Ballin has declared to be the aim of the Germans, the completion of the Berlin-Budapest-Belgrade-Byzantium-Bagdad-Bahn railroad route connecting the Orient and the Occident by land, has been attained. The announcement comes from Germany that the tunnels thru the Taurus Mountains have been completed. If the Bagtchi tunnel of 16,000 feet thru the Amanus Mountain east of the Taurus proper is included, the way is now clear to the Mesopotamian plains. Munitions may be shipped from Essen to the Egyptian frontier or to the heart of Mesopotamia by rail, except for the ferriage across the Bosphorus; and cattle, corn, and cotton may be shipped directly to Germany. The German railroad to Bagdad is, according to English authorities, the best built in the world. It is laid thruout on heavy steel ties.

Russia

[Completion of Murman Railway in Russia. *Scientific American*, Feb 17, '17. 200 words.]

The Russian Chamber of Commerce in Paris has announced that the first trains have been run to the Murman coast over the recently completed Murman Railway. The length of the line from Petrograd to Alexandrovsk is about 930 miles.

South America

[The Railroad Buenos Aires-Callao. By J. Hurtado. *Memorial del Ejército de Chile*, Sept, '17. 5500 words. 1 map.]

In the year 1890 at a Pan-American conference in Washington the idea of constructing an international railway from Canada to Chile was presented. Later President Roosevelt named a committee composed of representatives of the various countries of Central and South America, with a meeting place at Washington, for the purpose of collaborating in the work of uniting the three Americas by rail. He also designated the financier, Charles M. Pepper, as a traveling delegate with the mission of making the propaganda for the projected line in the different countries interested.

The project has colossal proportions. Twenty American countries with an area of 3,000,000 square kilometers and a population of 200,000,000, English, Spanish, and Portuguese speaking peoples would be united.

The construction of this railway line would permit travel by rail from Puerto Mont to New York or Ottawa. The length of the line would be from 16,000 to 20,000 kilometers. Theoretically speaking, the journey from the two extremities of the continents could be made at a rate of speed of about 40 kilometers per

RAILROADS—Continued

hour, or in from 20 to 25 days. This would be the greatest railway line in the world exceeding, as it would, the Canadian Pacific line, which is 6000 kilometers in length, and the Trans-Siberian line, which is 9600 kilometers in length.

The obstacles to the consummation of this plan have consisted mainly in the lack of official accord between the Central and South American governments concerned, and also in the fact that the economic measures necessary to bring about surveys and the execution of operations have not as yet been effected.

It is probable that the completion of this line will take about 25 years in view of the work that will have to be done in crossing Central America, Columbia, Ecuador, and Peru; countries in which railways are scarce, and construction very difficult.

In view of the above inconveniences, seven South American States, namely: Peru, Bolivia, Brazil, Uruguay, Paraguay, Argentina, and Chile, have directed their energies to the construction of a railway network that will favor the development of commercial relations, and also of social relations, between the countries now isolated because of the lack of direct means of communication.

This alteration of the original idea does not conflict with the plan for the Pan-American railroad. On the contrary the union of the railway systems of the before-mentioned seven states, facilitates the realization of the larger plan.

It is proposed to connect by rail the capitals, Lima, Rio Janeiro. Montevideo, Buenos Aires, Santiago, La Paz, and Asuncion. (In continuation the article gives a description of the actual state of the line Callao-Buenos Aires, and discusses the commercial, political and military values that would accrue therefrom to the Republic of Chile.)

United States

[Note. *Army & Navy Jour.*, Oct 27, '17. 90 words.]

Since the present mobilization began 914,195 persons have been transported by the railroads for the War Department. 256,185 were transported in standard or tourist sleepers, the remainder in ordinary day coaches. This vast movement has been conducted without a single accident.

—Cars

[Record Breaking Car Shortage and the War. *Railway Age Gazette*, June 15, '17. 900 words. Table.]

The car shortage reported May 1 amounting to 145,449 cars, again broke all previous records. The largest shortage in previous years was 137,847 in February, 1907. The amount and time of the present shortage afford cause for uneasiness. It is not usual for a car shortage to occur in the spring, and the railroads face the prospect of a shortage lasting thru the summer and fall.

Commercial business has been of sufficient volume to cause a shortage, and now will come the army requirements of building and supplying ten cities of 50,000 population each in addition to the movements of troops.

But little can be done in the way of building new cars. The condition must be met by other measures. Shippers must co-operate with railroads by moving every possible item in the summer when traffic is normally light. Every car ought to be loaded to capacity and the allowed 10 per cent overload should be used whenever possible. Regulating bodies should impose no unnecessary restrictions on the railroads. It is no time for complaint for deficiencies that might be objected to under normal conditions.

—Cars—Armored

See also

COAST DEFENSE—BY MOBILE GUNS (Article: "Mobile Armament for Defense")

—Construction and Repair in War

[Work of Forestry and Railway Corps. *Canadian Military Gazette*, Oct 9, '17. 275 words.]

During the month of July the Canadian Railway troops numbering 8000 men, located 82 miles of narrow guage and 21 miles of wide guage railway. In addition they ballasted more than 100 miles of railway and kept other lines in repair. During the month nearly 300 miles of railway was being maintained by this force.

—Demolition of

[Railroad Wrecking in the Russian Retreat. Note. *Scientific American*, Nov 25, '16. 200 words.]

In the retreat after Tannenberg, the Russians left the track intact because the German rolling stock was of narrower gauge. The Germans moved one rail over to the desired gauge and then sawed off the ends of the ties to prevent possible later widening by the Russians. On their next retreat, the Russians exploded a cartridge at each rail joint. This ruined the rails and made it necessary to re-lay the track with new steel.

—Hospital Trains

See

SANITARY SERVICE—TRANSPORTATION OF SICK AND WOUNDED—HOSPITAL TRAINS

—In European War

See

EUROPEAN WAR—RAILROADS IN

—Railroad Troops

[Railway Troops. By Lhd. *Tidskrift i Fortification*, parts 3 and 4, '16. 5600 words.]

(A detailed account of the organization of railway troops (before the war) in the different European countries and Japan and when they were organized; the material used in the field; the use made of these troops and material during the wars from 1870 to 1914 and the methods used in construction and repair of lines.

Also, the question of the employment of railway troops in Sweden.)

—Rolling Stock

[Specially Designed Rolling Stock for Our Forces in France. *Scientific American*, Nov 3, '17. 260 words. Illustrated.]

Six hundred and eighty specially designed locomotives and over 9000 specially designed standard gage freight cars have been ordered for use of American forces oversea.

The war locomotive is a powerful one, tho not representative of the most powerful type used on our railroads. Like all army rolling stock it is painted battleship gray and bears the letters "U. S. A."

The freight car has an inside length of 36 feet and a capacity of 33 tons. It has the same coupling equipment and buffers as the French cars and can be interchanged with them. An iron railing running the length of the car over the middle of the top is intended to hold a tarpaulin which will protect the contents from the weather.

RANCAGUA, Siege of

[Study of the Siege of Rancagua. By Maj. Charpin. *Memorial del Ejército de Chile,* Sept, '17. 10,000 words. 3 sketches.]

(This is a study of the operations of the revolutionary forces under General Carrera in the War of Independence (Chile) prior to and during the siege of Rancagua in October, 1814.)

On Aug 18, General Osario, the royalist commander, arrived at Chillan and began preparations for an advance to the north. His force consisted of 5000 men organized in four divisions and commanded by his best officers. Under the personal command of this general the Royalist army took 32 days to march the 300 kilometers between Chillan and Requinoa where the concentration was effected on Sept 29.

On this date the Revolutionary army, organized in three divisions, was located as follows:

1st Division, in Rancagua, 1155 men under General O'Higgins.

2d Division, a league to the east of Rancagua, General J. J. Carrera in command, with 1861 men.

3d Division, at Mostazal, Col. Louis Carrera commanding, with 915 men.

General Carrera, the commander-in-chief, was in Santiago which city he left on Sept 30 to take command of the forces in the field. General Carrera's plan was to defend the pass of Angostura de Paine and afterwards to hold the line of the River Maipo. He also thought of offering battle on the plains of Maipo. General O'Higgins on the other hand was convinced that the line of the River Cachapoal should be held, and that the army subsequently should withdraw to and defend the town of Rancagua. It is not clear just what the latter officer hoped to gain by the curious plan that he advocated. These two commanders were in accord only on the one point, namely, that the Revolutionary army was in no condition to meet the enemy in open battle.

The bad effect of General Carrera's indecision was augmented by his absence from the theater of operations at the time when his presence was most needed. General O'Higgins was a great patriot and a brave soldier but he was so fascinated with the idea of defending Rancagua that he was unable to devote himself with ardor to any other course of action. From the military point of view his attitude can neither be understood nor justified.

Despite the decision of General Carrera to defend Angostura, little or nothing was done to strengthen this position and to prepare it for defense. The troops were to be found scattered in all parts of the country except in the pass to be defended. Meanwhile the Spaniards were approaching.

On Sept 30 General Osario reached Requinoa, within two leagues of the River Cachapoal, and encamped. His intention was to force a passage of the river during the night of Sept 30-Oct 1.

In the absence of the commander-in-chief, who was now en route to Rancagua, General O'Higgins divided his army in three groups and stationed a group at each ford. The absence of the supreme commander caused such vacillation and indecision that the western or Cortes ford was left unguarded. The Royalists by a night march effected an unopposed crossing and turned the position held by General O'Higgins who, with the 1st and 2d Divisions, withdrew to and occupied Rancagua. This city was totally unprepared for defense. Munitions were lacking, there were no food supplies and only enough water to last for two days. Had the Spaniards been so minded they could have taken the place without loss merely by investing it and waiting for the garrison to perish for want of food and water.

On the morning of Oct 1 the Spaniards delivered the first assault. The defenders had massed themselves in the open square in the center of the city and had barricaded the four principal streets leading from it. The Spaniards, disdaining even ordinary precautions, advanced on these streets and coming under heavy artillery and rifle fire in close formation were thrown back in disorder.

Meanwhile General Carrera had arrived at Angastura and had taken command of the 3d Division, which had not entered the city with General O'Higgins' forces. The Spaniards, profiting by the lesson of the first assault, made the second and third assaults at 4 and 7 p. m., respectively, advancing thru the houses instead of along the streets.

These assaults were beaten off but nightfall found the defenders short of water and almost without ammunition. General O'Higgins sent a message to General Carrera asking for ammunition. The reply was a vague message to the effect that "ammunition could arrive only on the points of bayonets," that "at daybreak the 3d Division would perform a daring deed" and that "the salvation of Chile required a moment of resolution."

General O'Higgins inferred that Carrera intended to surprise the Spaniards at daybreak by attacking them in rear. Carrera did not attack at daybreak but the Spaniards delivered the fourth assault at that hour. It was repulsed and at 10 a. m. the fifth assault was made. At 11 a. m. the 3d Division approached and opened fire on the Spaniards but withdrew after firing a few volleys. This defection left O'Higgins but two

RANCAGUA, Siege of—Continued

alternatives; to surrender, or to cut his way thru the besiegers. He chose the latter, and succeeded in breaking thru with a remnant of his forces.

There was no further organized resistance by the Revolutionists until the year 1817.

The causes of this disaster were as follows:

(1) Lack of political and social unity at the time of arrival of General Osario's army.

(2) Organic and intrinsic weakness of the *junta* that governed Chile at this time.

(3) Lack of a clear and definite plan of campaign.

(4) The adhesion to two separate plans by the two commanders of the higher units of the army.

(5) Lack of concert in the operations of the three divisions preliminary to the siege.

(6) Lack of care in providing for proper reconnaissance and communication.

(7) The absolute deficiency in the preparation of Rancagua for a siege of more than two days.

(8) Lack of proper direction when contact with the enemy was established.

(9) The transcendental error in shutting up the mass of the troops in a city.

(10) Lack of concerted action between the besieged forces and those that were outside.

(11) The lack of personal direction of operations by an efficient commander-in-chief.

RANGE FINDING

See also

Coast artillery—Range finding
Field artillery—Range finding

RAPID FIRE GUNS

See also

Machine guns

[A Rapid-Fire Gun for Skirmishers. *Canadian Military Gazette,* Sept 11, '17. 200 words. Quoted.]

In order to combat the German machine guns the French of late have introduced in their army a new quick-firing cannon of such construction that it can be readily carried forward by attacking infantry. Thus the skirmishers are able to put enemy machine guns out of action by well-directed shots from their 37-millimeter cannon, which they can carry along with them.

The French "37" is a befitting companion to the famous "75," which has figured so prominently in the French campaigns to date. The smaller weapon has every feature of its larger brother, including quick-firing breech mechanism, accurate sights and automatic recoil. Lying out on open ground the crew of two men can fire up to 35 high-explosive shells per minute. The shells measure almost 1½ inch in diameter, and the gun has a range well above a mile for accurate shooting. This odd little field piece can be readily taken apart and carried by six or eight men, and is available for use in advanced positions as well as in the open. It is a most workmanlike piece of armament for use under the conditions prevailing on the Western front.

RATIONS

See also

Subsistence

[The Intendence in Modern Armies. By F. Abeilke. *Memorial de Caballería,* Feb, '17. 2300 words.]

To form an approximate idea of the problems of supply in belligerent armies of to-day, it is enough to consider the number of combatants. This is higher than 30,000,000.

The war is absorbing practically all of the activity of Europe. Not only armies but entire nations are fighting. It is said that while an army does not fight every day, it does eat every day. The primary duty of the intendence therefore is to feed the army. In the continuation of this article a study will be made of the methods of supply of the principal armies of Europe.

[Supply of Modern Armies. By F. Abeilke. *Memorial de Caballería,* Mar, '17. 2500 words.]

(Conclusion)

All the belligerent armies count upon two classes of rations for subsisting troops in the field, viz., the ordinary ration and the reserve ration. The English in addition provide each soldier with an emergency ration weighing 185 grams composed of chocolate and milk.

The essential components are bread and fresh meat for the ordinary ration and hard bread and preserved meat for the reserve ration. The following table gives the articles and weights of ration components in the various armies. Weights are in grams:

	Bread	Meat	Vegetables	Salt	Coffee	Sugar	Hard bread	Canned meat
Germany ...	750	375	250	25	25	25	500	200
Austria	840	300	140	30	25	25	500	224
France	750	400	100	20	16	21	700	200
G. Britain..	557	577	227	16	13	50	453	453
Italy	800	500	280	50	15	22	600	200
Russia	1025	410	256	49	Tea 69	12	716	360

A German division of 18,000 men requires daily about 13,500 kilograms of bread and 6750 kilograms of meat (about 17 beef cattle).

Germany calculates her mobilizable effectives at 4,700,000 trained men, while her partially trained men aggregate about 5,700,000. These figures give some idea of the problems of the intendance in supplying such vast quantities of food alone. The German soldier carries with him three rations, the regimental train one ration, and the supply column four rations. The German army corps has twelve supply (subsistence) columns. Six are of from 27 to 36 wagons each (*Proviant-Kolonnen*) and six are of 62 wagons each (*Fuhrpark-Kolonnen*). There are also two field bakeries totaling 52 wagons, 24 of which are movable ovens.

(Here follows a brief description of the Austrian, French, English, and Italian supply organization for serving troops in the field.)

[Deficiencies of Our Nutrition. By Doctor Simon S. Rosenzweig. *Rev. del Círculo Militar,* Mar, '17. 2500 words.]

Recent experiments conducted on German soldiers by Doctor Loewe have demonstrated that small quantities of calcium salts administered in the daily ration have a very beneficial effect from a physiological standpoint; all vital functions acquired increased energy and the subjects developed increased resistance to many noxious influences, including common cold. In the case of wounded soldiers it was noted that the process of cicatrization of the wounds progressed much more rapidly when receiving daily doses of calcium salts.

That calcium is absolutely necessary to animal and vegetable life has long been known and it's therapeutic value has been recognized in the treatment of tuberculosis, pneumonia, catarrhal affections and various nervous disorders.

The calcium necessary for the maintenance of life is taken into the body in the animal and vegetable foods, but not always in sufficient quantities. Many diets otherwise satisfactory as to albumen, fats and carbohydrates are deficient in calcium.

Eggs, milk, and vegetables are rich in calcium salts, but form a relatively small part of our diet as compared with meat, potatoes and bread, which are poor in calcium and contain an excess of magnesium, which is prejudicial to the life of the tissues.

An examination of the ration of the different armies discloses as follows: The English soldier receives the most abundant and best balanced ration (1.464 gr. calcium and 1.230 Mgn.); the French ration is very similar to the English (Ca. 1.464 gr., Mgn. 1.436); much less satisfactory in every respect is that of the Austrian and Italian soldier (Ca. 0.535 gr., mgn. 0.604 gr.); the poorest of all, as to quantity and quality and for absolute deficiency of calcium is the German ration (Ca. .0466 gr., Mgn. 0.656).

The Argentine soldier receives a ration superior to that of the English and French as to quality and quantity, but the relation between the calcium and magnesium salts is not so satisfactory (Ca. 1.470 gr., Mgn. 1.680).

The figures given relate to the peace ration; in time of war all soldiers receive increased food supplies, but the shortage of food thruout Germany is so pressing that it is probable that the German ration has been greatly reduced.

In view of the results obtained in his experiments, Professor Loewe has recommended an increase in the quantity of calcium in the ration of all soldiers, including the sick and wounded; this is readily accomplished by mixing a fixed proportion of chloride of calcium with the flour to make a calcium bread.

Russia

[The Russian Soldier's Food. By Scotland Liddell. *Sphere,* Nov 6, '15. 300 words.]

The Russian soldier's daily ration is 2½ lbs. of bread, ¾ lb. of boiled fresh meat, as much soup as he wants, and kusha, a grain resembling barley when cooked. This is supplemented by a monthly allowance of ¼ lb. of tea and 5 lbs. of sugar.

The soldier has breakfast at 6 o'clock consisting of tea and black bread. At 12 o'clock, he has cabbage or other thick soup, kasha in grease, the allowance of boiled meat and black bread. At 7 p. m., he has soup with lumps of meat in it, black bread and tea. The soldier receives a monthly allowance of two pounds of machorka, the chopped up roots of tobacco.

RECONNAISSANCE

See also

CAVALRY—RECONNAISSANCE

[Finding the Way by the Sun, Moon, and Stars. By Maj. G. N. Wyatt, R.A., Chief Instructor, R. M. Academy. *Jour. Royal Artillery,* Apr, '16. 5000 words. Illus. 2 tables.]

(This is an astronomical article and does not well admit of digesting. The various astronomical terms in common use are defined and rough methods of computing time and direction from approximate observations of the sun and stars are given. The article is accompanied by a number of plates showing the relative locations of the principal constellations; and also by examples to illustrate how to compute time and direction by use of the methods explained.)

[A Reconnaissance. By R. Lebenetz. *Voenny Sbornik,* Apr, '17. 3000 words. 1 map.]

A personal account of a reconnaissance made by the author on Aug 20, 1914, in East Prussia. On this date three Russian divisions were in line near Kattenau, in order from north to south, the 28th, 29th and 25th divisions. A cavalry force was still further to the north, but contact with it had been lost. Late in the afternoon the author was sent out with 14 troopers, with directions to move in a general northwestwardly direction, and determine what hostile troops if any were in this direction. The only information of the enemy at hand was that there was some infantry and artillery in front.

Starting west the author was soon brought to a stop by infantry fire. Turning northwards, he rode into the village of Schillgallen, which he found deserted. From here he, however, observed about two companies of hostile infantry with a machine gun intrenched towards the east, and apparently this German force was at the moment for unknown reasons in a confused condition. A message was sent in, in duplicate, at this time with the news so far obtained. The reconnaissance was then continued.

Shortly afterwards, from the same vicinity, a column of German kitchen wagons was observed on a road to the west, and later artillery was seen near Brakupinnen. The author's estimate of the situation was that the Germans had lost connection between their various forces, and a second dispatch was sent off to this effect. Later the German forces were observed moving north. Darkness was now approaching, and the author, moving to within a half-mile of the German column, found about 8 hostile troopers fairly close to where the author was concealed. Firing one shot, which dismounted the German officer in command of the 8 men, and then charging, the author

RECONNAISSANCE—Continued

succeeded in capturing this German officer, found to belong to the 8th Hussars, and later succeeded in bringing him back to the Russian lines. The author now concluded his reconnaissance, and returned to his command without incident.

This reconnaissance was the basis for the Russian high command's estimate that the Germans were retreating, partly in disorder, and that on the following date the enemy would be found in line west of the Inster River.

[Cavalry and Aviation. By José de Elola. *Memorial de Caballería,* May, '17. 2700 words.]

Admirable technical and organic preparation and the vast difference between it and the Allied armies were what protected the German army from the consequences of the grave strategic errors committed by the higher command in the early stages of the war.

It is now patent that the great duration of the war and the indecisive character of the battles are due to Germany's initial error in trying to operate offensively on both the eastern and western fronts when her forces were not equal to those of the opposing coalition. The war now appears to have degenerated into a combat of position. It is not to be doubted that in future wars artillery will fill the primary rôle that its ever-growing importance demands, but it is to be feared that preponderance in this arm, especially in the heavier types of guns, may tend to immobilize armies, and in this way prolong wars.

Military students know that the decisive victories that terminate wars are gained by the employment of *forces in movement.* Some officers now affirm that in a war movement cavalry is no longer indispensable, its functions having been taken over by the aviation corps. (The purpose of the article is to discuss the relations that cavalry and aviation bear to each other, and to the other arms, and to draw attention to the error of certain ideas now current with reference to the powers and limitations of the new arm.

This number includes only the preamble.)

(To be continued.)

[Cavalry and Aviation. By J. de Elola. *Memorial de Caballería,* June, '17. 3000 words.]

(Continuation of a preceding article. The use of aircraft as an adjunct to cavalry is recommended. Aircraft could not replace cavalry, but would be of particular use to the latter, especially when it is employed independently in reconnoitering the country and in getting information of the position, strength and movements of the enemy.)

RECRUITING

[Gains in Enlistments. *Official Bulletin,* July 6, '17. 100 words.]

The Secretary of the Navy announces that on July 5 there were in the navy 128,389 enlisted men, and in the marine corps 859 officers and 28,277 enlisted men.

RECTIFIERS, Current

[Electrolytic Alternating Current Rectifiers. By Capt. Adelno Gibson, C. A. C. *Jour. U. S. Artill.,* Sept-Oct, '16. 4000 words. Illus.]

When electrical energy is transmitted to considerable distances, it often is desirable to use a high alternating voltage in transmission, to save copper, and then at the receiving end, to change to a direct voltage of 120 volts or less.

Change to direct voltage may be brought about by three general methods:

1. Mechanical, including:
   (a) Rotary converters.
   (b) Motor generators.
   (c) Electro-magnetic rectifiers.
2. Mercury-arc rectifiers.
3. Electrolytic rectifiers.

For large values of current, the rotary converter or motor generally is used, the latter most generally in the Coast Artillery.

For relatively small values of current, as in charging the 30-volt telephone storage battery, the mercury arc rectifier is used in the Coast Artillery and largely in commercial practice for similar service. For charging the 6-volt batteries, used on motor boats and automobiles, a small mercury arc or an electro-magnetic rectifier is used.

The electrolytic rectifier, sometimes called a Nodon Valve after Albert Nodon, who conducted a research into the valve and whose data thereon are adopted as standard, depends for its effect upon the fact that certain electrolytic cells will allow a current free passage in one direction, but offer high resistance to passage in the opposite direction.

This rectifier can be improvised readily at small cost and will be found very useful at posts where commercial alternating power is available, for such purposes as charging the 30-volt telephone storage battery or running small D. C. motors, from the commercial power mains and thus save the expense of operating a large D. C. power plant.

The essentials of the valve are a metallic cathode of small surface, an anode of large surface, and an electrolyte.

For the anode, lead, polished steel, and carbon, are satisfactory substances, lead being the best of the three. Aluminum, either pure or alloyed with a very small percentage of a foreign substance, is the only satisfactory material for the cathode. Nodon obtained the best results with an electrolyte composed of a concentrated solution of neutral ammonium phosphate. Sodium carbonate gives almost as good results, is inexpensive, and easily obtained.

The area of the anode should be as great as the cell will hold conveniently. The area of the cathode should be relatively small, for it is the aluminum hydroxide formed on its surface that tends to prevent the current from passing from the aluminum to the lead.

The gravity cell jars answer very well for the cells. They should be set in running water to carry off the

heat, as the efficiency of the rectifier decreases rapidly with increase in temperature of the electrolyte. Nodon recommends a temperature below 100° F.

Sparking, when 110-volts are impressed across the rectifier, may be eliminated by coating the surface of the electrolyte with oil, or by connecting a rheostat on the A. C. side, or by wrapping manson or other insulating tape around the top of the aluminum plate and extending about half an inch below the surface of the liquid.

A four-cell rectifier will be found most satisfactory in practice.

(Diagrams showing the method of connecting up the rectifier accompany the article.)

RED CROSS SOCIETY

—Organization and Administration

[Red Cross Military Units. *Modern Hospital,* June, '17. 1000 words.]

Red Cross units authorized by the War Department for service with the Medical Department of the army comprise base hospitals, hospital units, surgical sections, and general hospitals.

The service of the rescue and care of the sick and wounded of armies is divided into three zones. The first zone is called the service of the front, and extends from the line of battle back to the field and evacuation hospitals. This zone is operated by the medical service of the army and Red Cross organizations do not usually participate. The second zone is that next behind where in the *base hospitals* the patients first meet the usual care and comforts of a real hospital. The third zone is that of the home country, and here the *general hospitals* are found. The destinction between base and general hospitals should be remembered.

A *base hospital,* when called into service, is established where the military authorities need it. Such a unit must be organized by a parent institution—large hospital or medical school—so that the personnel will be accustomed to working together, and the parent institution must be large enough to share the personnel without disrupting its work. The next requirement is to find a member of the staff combining the personal and professional standing who, as director, can organize the hospital. The third requirement is the ability to raise $25,000 for equipment. This may be done by the local Red Cross chapter, which must also furnish the necessary hospital linen, hospital garments, and surgical dressings. The creation of these large and complex organizations is done in a definite way which has the approval of the War and Navy Departments.

Hospital units are organized groups of physicians, surgeons and nurses, with a number of orderlies, which may be utilized at established military hospitals, or on hospital trains or ships. Since they assist at established institutions, they need only operating equipment for the surgical section, and instruments and appliances for the medical section.

Surgical sections are special detachments intended to reinforce operating staffs in emergencies. They require surgical instrument equipment. The staff consists of four surgeons, seven nurses, two orderlies and a clerk.

The base hospital, hospital unit, and surgical section must go where their services are needed. Only the largest hospitals should attempt the organization of a base hospital. Smaller hospitals should undertake the formation of hospital units or surgical sections.

Civil hospitals may be taken over for use as *general hospitals,* or they may give up a certain number of beds to the care of military patients. Service in the general hospitals does not necessitate leaving home.

Sanitary training detachments are units for instruction of men in first aid, the transportation of the wounded, and other matters a knowledge of which is required for service with the sanitary department of the army. The organization of these detachments is a proper chapter activity, and every Red Cross chapter should support and buy the equipment for at least one of thm.

[Note. *Army & Navy Jour.,* July 7, '17. 200 words.]

The effort to raise $100,000,000 in the U. S. for the Red Cross War Fund in the week ending June 25 resulted in realizing a total of $114,000,000.

REFRIGERATION

[An Ice Making Plant on Wheels. *Scientific American,* Nov 3, '17. 240 words. Illustrated.]

This plant attached to the Columbia War Hospital is capable of turning out 2½ tons of ice every 12 hours. The plant is mounted on a trailer and is hauled by motor truck. The plant consists of 48 tanks surrounded by a system of ammonia pipes, and a gasolene engine which drives the ammonia compressor. Each tank produces a 50 pound cake of ice.

RELIGIOUS INTERESTS of Soldiers

See also
CHAPLAINS

REPRISALS

See also
EUROPEAN WAR—ATROCITIES IN

RESERVE

Argentina

See
ARGENTINA—ARMY—RESERVE

Chile

See
CHILE—ARMY—RESERVE

United States

See
UNITED STATES—ARMY—RESERVE

RESPIRATORS

See also
ASPHYXIATING GASES

REVOLUTIONARY WAR (U. S.)

See
AMERICAN REVOLUTION

RIDING

See

Equitation

RIFLES AND RIFLE SHOOTING

See

Infantry—Arms—Rifle

Infantry—Fire—Rifle shooting

RIVER CROSSINGS

See also

Bridges, Military

Kahoc

—In European War

[A Piece of Pioneer Work in the Winter of 1914. Anonymous. *Schweiz. Zeit. f. Art. u. Genie,* Apr, '16. 1500 words.]

(Extract from *Dangler's Armee Zeitung.*)

The article gives an account of the difficulties encountered by Austrian pioneers in floating a ponton bridge by sections down the Vistula from Grabie to Swiniarów at which place a crossing had to be constructed for the 17th Army Corps with its heavy artillery and trains in the latter part of November, 1914. Alongside the ponton, a temporary wooden bridge was also constructed from material obtained in the nearby woods. The heavy ice which soon formed in the river made it necessary to take up the ponton anchors and cables, substituting therefor a long cable stretched across the river above the ice to which the pontons were attached. The spar bridge was also protected by railroad rails against drifting ice.

The Russians in the meantime began to take the bridge crossing under indirect artillery fire and launched a strong flank attack against the divisions which had crossed the river. A withdrawal was finally decided upon, but the bridge had to be held open until the rear guard brigade had crossed, whereupon the pioneer company had orders to blow it up if necessary. Steps were at once taken to send back all bridge material. Under hostile artillery and infantry fire, all ponton matériel was successfully recovered and the temporary bridge completely destroyed and removed, thus preventing pursuit.

Upon arriving at Nielpomice the next day, the company was again called out to construct another bridge at a crossing of the Vistula to the north. Two days later it was moved to Cracow and shortly thereafter was transferred to the Carpathians for construction of field trenches and fortifications under hostile fire.

[Three River Crossings During the World's War. Tactical and Technical Considerations. By Col. Immanuel. (Translation from German.) *Krigs Vetenskap. Akad.,* Sept, '16. 7700 words. 3 map sketches.]

A river that runs directly across the advance of an attacking army is a particularly difficult obstacle and its crossing should never be undertaken by a field general, without great moral and physical superiority.

Attention is called to such brilliant accomplishments in crossing rivers as those of Napoleon's passage of the Adda at Lodi in May, 1796, of the Danube at Aspern and Wagram, 1809: how it took the Russians several weeks before they dared to cross the Danube in 1877 even tho it was defended by poorly led Turkish troops: also the Japanese crossing of the Yalu (1904). These are brought to mind so that it is possible to point out more clearly how great have been the changes even in this field during this war. The earlier struggles above mentioned lose a great deal of their significance, when we consider the masses of troops now involved, and the assistance that is at hand both for defender and attacker alike, not only in the most modern artillery but also in all kinds of modern technical equipment such as armored motor boats, river mines, airships, etc., which completely upset the very fundamentals of struggles for river lines.

The three most important river crossings are:

1. Woyrsch's crossing of the Vistula between Ivangorod and Warsaw, July 28-30, 1915.
2. Forcing of the Narew fortified line July 18-Aug 10, 1915 by the right flank of Hindenburg's Army.
3. The passage of the Danube and Save by Mackensen's army Oct 6-11, 1915.

1. *Woyrsch's Crossing of the Vistula*

After the capture of Lemberg, July 22, 1915, it became necessary for the German and Austro-Hungarian troops in the eastern theater to make a general attack against the Russians who still remained in Poland with the view of either enclosing them within the Warsaw-Ivangorod-Brest-Litowsk-Grodno line, or merely to force them to retire eastward, out of Poland. Therefore Mackensen pushed his army north between the Vistula and the Bug; on the left bank of the Vistula was an army under Woyrsch advancing against Ivangorod, one under Prince Leopold von Bayern against Warsaw, and Hindenburg's right flank against the Narew line (Novogeorgievsk—Grodno). Great resistance was encountered on this line as it was well fortified. Likewise General Nikolojuvitsch put up a stiff defense with the right flank of his army resting in the fortified Ivangorod district and the left on the Bug above the fort of Brest-Litowsk. Thus it became a difficult task to break thru.

On July 21, Woyrsch was 15 kilometers from the southwest front. It was his task to cross the Vistula between Warsaw and Ivangorod and the place selected was the mouth of the tributary Radomka on both sides of it. In itself the Vistula was not a great barrier, the average depth being about 2 meters, width about 600 meters, and the current was considerably reduced due to low water at this time.

Every precaution was taken to keep the plan secret. For a distance of 15 kilometers, 10 places for crossing had been selected, so that at the very start the enemy would be attacked on a broad front. Heavy and light artillery were placed so they could open fire at day break if necessary. By the evening of July 27th all preparations were completed, and at 10 P. M. infantry troops advanced to their respective places of crossing so as to arrive at 1:30 A. M. The embarking in pon-

toons was done without interruption, but at 1:45 the Russian artillery suddenly opened fire. However, the German artillery gained control, and under its protection the passage was successful and by 2:15 A. M. several battalions had succeeded in entrenching themselves on the other side, besides taking 200 prisoners. The Russians had clearly allowed themselves to be surprised and overpowered and were in no position to prevent the actual crossing. Counter attacks were unsuccessful in their attempt to force the Germans back.

2. *Forcing of the Fortified Narew Line*

The Narew line constitutes the Polish fortified northwest front, the particularly strong section beginning about half way between Ossowiets and Grajewo on the northeast, thence to Kolno, Krasnosielc, Prasnysz, Plonsk and ending with its southwest flank resting on the Vistula in the vicinity of Wyszogrod. This line was protected by means of forts, redoubts, advance lines 20 kilometers deep consisting of series of rifle pits, sand bag breast-works, long stretches of woods converted into abatis defenses, and three lines of barbed wire entanglements. The Russians had aimed at all hazards to hold the Germans on this line.

The attacking forces consisted of two armies, one under Gallwitz on the west side of the Szkwa; and the other under Scholtz on the east side. The attack began July 13, and by the evening of July 15, the Russians had lost 50,000 men including 21,000 prisoners. By July 18, Gallwitz had reached the Narew River, his line starting from Pultusk passed Rozan and up to but not including Ostrolenka and Scholtz from Ostrolenka to Lomza.

The Narew River is a particularly formidable barrier because its shores and contiguous lands are swampy; during the rainy season it is well-nigh impassable except by well established roads to bridges. Above Lomza it is from 60 to 100 meters wide, and about 2 to 7 meters deep. Between Lomza and Ostrolenka there are several fordable places during the summer and below Rozan its depth is 3 to 4 meters. By means of corduroy roads, the Germans succeded in bringing up pontoons and artillery, and during the nights July 19-20 to 20-21 they had made several crossings and, in spite of severe attacks, they had been able to hold them. During this attack the co-ordination between the artillery, infantry and engineer troops is most extraordinary and almost alone accounts for this remarkable success in face of what was considered unsurmountable odds.

3. *Passage of the Danube and Save*

Due to the fact that Italy had declared war in May, 1915, and to the efforts of England, France and Russia to induce Rumania, Bulgaria and Greece to join them in this war, this area became very important. As Bulgaria threw in her lot with the Central Powers, these nations wanted to give her support and overawe the remaining ones by quickly combining their forces and occupy Serbia. With this object in view Austro-Hungarian troops were quietly assembled along the Save and Danube opposite the Serbian frontier, by the first week in October, 1915.

The campaign was planned with the following in view:

1. The armies of Gallwitz and Kövess of Mackensen's army groups to cross the Danube and Save and invade Serbia.

2. The Bulgarians to attack simultaneously on the east and surround or force the Serbian army into Albania.

3. This to be done with the utmost speed so as to complete it before the English at Salonika could give assistance.

4. To restore communications with Turkey.

Accordingly it was of the gravest necessity to push over the north boundary of Serbia which by reason of the Save and Danube was unusually strong. Here the technical difficulties were greater than any encountered in any other war.

From its junction with the Drina to its mouth at Belgrade, the Save flowing thru a swampy region has a width of 500 meters and a depth of 3 to 4 meters. On the south shore, between Obrenove and Belgrade, are hills which have a greater elevation than those on the Hungarian side. There were no bridges. Even more difficult than the Save is the Danube. From Belgrade to Bazias the shores of the Danube on Hungary's side are flat while on the Serbian side there are considerable elevations, an excellent defensive line, with Semendria and Pozarevac fortified. The river here is about 1200 meters wide and 5 to 10 meters deep. There are a number of islands covered with underbrush. Below Bazias as far as the Rumanian boundary, the river narrows for about 130 kilometers flows virtually between cliffs; in some places only 170 meters wide and in other 700 meters, its depth varies from 3 to 50 meters with an exceedingly strong current. Anticipating a passage at this place, the Serbians had placed their first army, consisting of 7500 men, along this section with batteries commanding the most favorable crossings. The second army held an exceedingly long line from Belgrade to the tributary Marava, and the third from Belgrade to Drina. In all, Serbia had about 250,000 men but considering they must also meet the Bulgarians, the number available for defense of the Save, the Danube and the Drina became relatively weak, with no reserves.

The Germans hoped by massing troops thruout the whole length from the Drina to Rumania and by simultaneous attempts, to gain passage at several places. Accordingly they had four large groups:

1. The Visegrad group against the west side over the Drina.

2. An army under Kövess between Sabac and Belgrade over the Save.

3. An army under Gallwitz between Belgrade and Bazias with orders to begin the crossing of the Danube.

4. The Orsova group to feint a principal crossing near the Rumanian boundary.

By careful patrolling, the enemy was kept in ignorance of the points where the first crossings would be made. On Oct 6th, passage was made at Bazias. At daybreak, the German artillery opened such a terrific

RIVER CROSSINGS—Continued

fire that in 3 hours they silenced the enemy's and even the infantry, so that several companies crossed in row-boats without being fired upon. Passage was also made at Temes island that day, but at Semendria it did not succeed until the 8th. This army completed its crossing by the 11th.

Kövess' army crossed in two groups on both sides of the Danube, the left group over that river at the so-called "Great War Island" directly against the forts of Belgrade, and the right group over the Save against the southwest part of the city.

The Orsova group continued with their feint until the 22d, when the Bulgarians succeeded in crossing the Trinok and got into Serbia. Six weeks later the Serbian army had been disposed of, the whole country subdued, and another campaign completed.

[Three Battles on the Banks of Rivers. By Col. Immanuel. Published by the U. S. Engineer School. *Memorial del Ejército de Chile,* March, '17. 8000 words. 2 sketches.]

An analysis of the following river crossings.

(1) The passage of the Vistula by the Army of Woyrsch between Ivangorod and Warsaw, 28 to 30th of July, 1915.

(2) The taking of the fortified line of the Narew, July 18, 1915 to Aug 10, 1915, by the right wing of the Army of Hindenburg.

(3) The passage of the Danube and the Save, Oct 6 to 11, 1915, by the Army of von Mackensen.

The above operations, from the tactical point of view, serve as models of their species.

ROADS, Military

[Lines of Communications at the Front. By N. Sbishnikov. *Voenny Sbornik,* June, '16. 3700 words.]

The first part of this article, which is a continuation from the preceding number of this journal, deals with the upkeep of roads in general, and does not present much information of value. It, however, appears that the Russians have given considerable thought to the maintenance of roads in rear of their forces in the field, and have organized large working parties with this end in view. It is noted that roads are divided into sections, the length of which varies with the season of the year, and that such sections are the units of maintenance work; their length in the drier periods is from 8 to 10 versts, and in the wet seasons from 2 to 4 versts.

The next part of this article treats very briefly of special materials needed for roads deep in mud, particularly on approaches to fords or bridges, and on steep grades.

The maintenance of roads is recommended to be divided into two main divisions, one in the theater of military operation, where occasional interruptions by the enemy are to be expected, and the other in rear of the first. In the first, only military labor should be employed, as it is evident that the working parties are liable to be drawn into an engagement. The number of roads to be kept up should not be less than one to a division, but the character of roads, and especially of bridges should be adapted to the class of troops to be supplied over the roads; it would be manifestly unnecessary to construct strong bridges when foot bridges would be sufficient for all practical purposes.

[Road Work in Mexico with the Punitive Expedition. By Capt. James A. O'Connor, C. E., with Comments by Maj. Lytle Brown, C. E. *Professional Memoirs,* May-June, '17. 6700 words. Illustrations.]

The possibility of maintaining the punitive expedition in Mexico depended largely on furnishing supplies regularly. What little could be obtained from the country had been used up in the first movement. At no time while the expedition was in Mexico was it believed that it would remain three months longer. This, in itself, eliminated from consideration the construction of a railroad, or even of plank or metalled roads, for a force the size of the expedition, which consisted of five cavalry regiments, four infantry regiments, one artillery regiment, three companies of engineers, with signal troops and medical and quartermaster personnel.

The expedition headquarters were first established in the latter part of March, at Namiquipa, 243 miles south of Columbus, New Mexico, the road extending to San Antonio, 79 miles farther to the southeast. At first the urgently needed supplies had to be transported by truck from Columbus. The truck trains were run night and day over dirt roads which did very well for the first few trips, but which rapidly became impassable. No advance supply bases could be established as the current demand was never exceeded. Toward the end of April the bulk of the supplies began to be shipped by rail from El Paso to Colonia Dublan, 108 miles south of Columbus. There was still transported by truck from Columbus an average of about 40 tons daily, requiring one train of 33 trucks each way. An advance base was now established at Namiquipa, supplies being hauled from the railroad at Colonia Dublan.

The section of Mexico that was occupied is practically a desert plateau 4000 feet above sea level at Columbus, about 5000 feet at Dublan and 6000 feet at Namiquipa with several small ranges up to 3000 feet above ground level. The soils are alkali, sand, gravel, clay or adobe, with their mixtures, varying from a fine, friable alkali dust to a fairly compact mixture of sand, gravel and adobe. In the few sections where the road could be located on ground of this latter character, satisfactory results were obtained. In the main, however, great difficulty was experienced in keeping the roads passable by the simple pioneering methods possible—that is by filling chuck holes, removing rocks, fixing arroyo crossings and opening up new stretches as the roads became impassable. No funds for the purchase of supplies and equipment and the hire of labor could be obtained for several weeks.

The fact that no water could be obtained for road work made permanent repairs impossible. Chuck holes were cleaned out and filled with gravel, but this was soon pushed out, being necessarily put in dry. At-

tempts were made to surface the sandy stretches with gravel and with adobe and caliche (a mixture of sand and gravel), but without water this proved of little value.

In general, little could be done to repair the dirt roads, which by June had a covering of from one to two feet of dust. The main solution was to open up new roads when the old ones became worn and to keep the arroyo crossings in repair. Where practicable the arroyos were bridged if timber could be obtained. Elsewhere the banks were cut to a convenient slope and two tracks, two feet wide, were built of flat, two-man stones set on edge with their long dimensions crosswise and tightly wedged.

Two trestle bridges were built: one, 180 feet long, over the Casas Grandes River at Vado de Fusiles; and the other, 150 feet long with a 1050-foot stone causeway, over the Santa Maria River at El Valle.

It became evident by the 1st of June that the expedition would be in Mexico during at least a part of the rainy season (July, August and September). A day's heavy rain in May had stopped all traffic, and the natives and American scouts were positive in their statements that the truck trains could not get thru during the rainy season. The engineer officer in charge of the road did not, however, take such a hopeless view of the situation. Knowing the rapidity with which a well-drained, graded earth road could be constructed and how quickly it could be reworked, he believed that a better road could be maintained during the rainy season than before, when the chief difficulty had been lack of water. The average rainfall in the country is about 15 inches, most of it falling during the three months of the rainy season.

It was finally decided to build a graded road as a wet-weather road and to continue the use of the pioneered roads in the dry season. There were accordingly provided about 60 Jeffery trucks and road machinery consisting of tractors, graders, rollers, scrapers and drags. Provision was also made for hiring as many Mexican laborers and teams as could be used to advantage, the force varying from 250 to 800 laborers with a maximum of 250 teams. The graded road was made 26 feet wide with ditches 1½ to 2 feet deep, with no shoulders and with the crown about six inches above the original ground level.

In the latter part of June the expedition headquarters were established at Colonia Dublan with troops at El Valle, some 65 miles to the south. By Sept 1 the crowned road had been completed to a point 10 miles south of Dublan. From there to El Valle no grading was necessary but the arroyo crossings were put in shape. Up to this time there had been barely sufficient rain to make the graded road passable, but the dry weather road had become impassable and the graded road was the only available route. As the road was built without binder the compacting process was slow and laborious. With some heavy rains in the first part of September, however, the effect of the compacting by the trucks and the dragging became more pronounced and a comparatively smooth dirt road gradually developed. In this condition the procedure was to drag the road as soon as possible after each rain and to drain any low spots where water had collected. The graded road was maintained in good condition until about the end of September, when a succession of dry, hot days reduced it to an impassable condition and the dry-weather pioneered roads were again used.

With the road machinery on hand a new system of maintenance on the pioneered road was developed. It consisted in grading out the ruts with a tractor and grader instead of attempting to fill them. This results in a sunken road and permits the use of hardened virgin ground without having to open new roads. This "shaved" road, as it was called, is a decided departure from usual road making principles. Having no drainage, it would not be suitable for wet weather, but answered admirably under the existing conditions. From October, when the shaved road was started, until the withdrawal of the expedition in February, 1917, one road was sufficient. In places it was scraped to a depth of 1½ to 2 feet, the average depth being about one foot, with a width of 16 feet. The amount of material that had to be removed to keep the road in good condition was surprisingly small.

The experience with road machinery was quite definite. All types of tractors except the caterpillar were discarded. The steam rollers were of little advantage under the conditions and were not used long. Road graders with a six-foot blade proved too light for road construction. They gave good service in maintenance of the graded road, but most of such work could be done with a drag.

The equipment that gave satisfactory service were the 75-horsepower Holt caterpillar tractors, Jeffery trucks, large 12-foot blade graders and the road drag of the type shown in the U. S. Department of Agriculture Bulletin No. 597.

ROCKETS

—Anti-Aircraft

[Incendiary Rockets Which Spell Doom for Captive Balloons. *Scientific American,* Mar 31, '17. 230 words.]

A test was recently made at the Mineola, L. I., flying grounds of a device for attacking captive balloons. It consists of a brass tube, four feet long, open at one end and fitted with a plug at the other. Into this tube is placed a special incendiary rocket whose fuse is incorporated into an electric circuit so that it may be fired electrically upon the closing of the circuit by a push-button in the cockpit of the airplane. The tube, being rigidly held in place, cannot be aimed at the target. The aviator must maneuver his machine until the tube is pointed at the target, when the electric circuit is closed and the rocket discharged.

ROUMANIA

See
RUMANIA

ROYAL FLYING CORPS

See
AERONAUTICS—GREAT BRITAIN

RUBBER

[Rubber. Quoted from *La Nature*. *Memorial de Artilleria,* Nov, '16. 400 words.]

No one is ignorant of the fact that rubber is of primary necessity in war, especially when is taken into account the immense importance it has acquired in motor transportation and aviation. The consumption of rubber is enormous in the manufacture of tires for wheels of automobiles and aircraft, and in addition there are many other uses and applications, among which may be mentioned the substitution of rubber or ebonite for the wood of gun stocks. This innovation has been introduced by the Remington Arms Company in the filling of a large order for rifles given this firm by the Russian government, and which it would have been difficult to complete had it not been possible to substitute rubber for walnut of the grade required.

Unfortunately the number of countries which are producers of rubber is very limited, and it is not strange that these countries that do produce this article are doing all in their power to increase the production. The production during recent years is given by *La Nature* as follows:

World production	Tons
1913	115,000
1914 decreasing to	108,000
1915 increasing to	146,000

The above figures give some idea of the importance which this article has attained in the present war. With reference to cost, recent quotations delivered at Marseilles are as follows:

Para rubber, per kilo., 9 francs.
Plantation or cultivated, 9.7 francs.

Altho efforts have been made to produce rubber by synthetic methods, up to the present time it appears that the results have not been satisfactory. It is of great importance that this problem be solved as far as our country is concerned, inasmuch as it will be impossible to import this article in case of war. Rubber is to-day an indispensable accessory of a modern army.

RUMANIA

—History

See also

EUROPEAN WAR

[Roumania and the Strategy of the Balkan Peninsula. By T. Miller Maguire, M.A., LL.D., F.R. Hist. Soc. *United Service Magazine,* Oct, '16. 2000 words.] (Historical.)

RUSSIA

—Army

See also

RATIONS—RUSSIA

—Army—Organization

[Russia. *Revista Militar,* Aug, '16. 1500 words.]

General Organization of the Army

The Empire is divided into 13 military districts. In time of peace there are 37 army corps with 59 divisions; also 23 cavalry divisions. The cavalry division consists of 24 squadrons and 2 horse batteries. The army corps in time of peace generally consists of 2 divisions; 29,000 rifles, 1810 sabers, 112 guns, with additional guns of heavy caliber.

Infantry

The typical formation is 4 companies to a battalion, 4 battalions to a regiment, 2 regiments to a brigade and 2 brigades to a division. There are 1258 battalions in active service. The battalion aggregates in peace about 500 effectives, in war about 1000. Infantry and fortress troops aggregate, in time of peace: infantry 793,000, fortress troops, 22,000; total, 815,000.

Field Artillery

The artillery organization is peculiar. Batteries have from 4 to 8 guns each, under a lieutenant colonel. They are divided independently into two parts, so that in reality each battery is a "group." Two or three batteries form a regiment, 2 or 3 regiments a brigade. There are 61 brigades in the active army with 199 regiments or "groups." The total number of batteries is 549; a battery in time of peace has 5 officers and 164 men, in time of war, 6 officers and about 201 men. The field artillery aggregates: active army, 192,942 men; fortress troops, 850 men; total, 193,792 men.

Heavy Field Artillery

There are 58 batteries, peace strength per battery, 3 officers and 119 men; war strength, 3 officers and 238 men.

Fortress Artillery

There are 264 companies, peace strength (approximate), of a company is 3 officers and 119 men; war strength about 3 officers and 238 men.

The total is as follows: fortress artillery, 18,056; coast artillery, 14,152.

Cavalry

The cavalry organization varies largely. A regiment has from 2 to 6 squadrons. There are 745 squadrons in the active army. A squadron has about 5 officers and 150 men in time of peace, in war time about 5 officers and 163 men. The cavalry totals about 138,000 officers and men in time of peace.

Technical Troops

There are 299 companies of these, whose organization varies greatly. They should aggregate about 37,448 officers and men.

Supply Trains

In time of peace there are in Europe 5 battalions of 4 companies each. In Siberia there are 2 companies. The war organization is not known.

Sanitary Troops

The organization of these troops is not known. The officers have civil but not military rank.

Remarks

There are many officers of infantry, cavalry and artillery who are not included in the foregoing figures.

Police, etc., are also excluded. The total effectives in time of peace aggregate about 1,284,000 officers and men. In time of war over 6,000,000 trained men are available for service.

Military service is obligatory.

Résumé of Forces, Peace Strength

	Men	Guns
Infantry	815,000	
Cavalry	138,000	
Artillery	186,000	3904
Other arms and departments	65,000	
Total	1,204,000	3904

Résumé of Forces, War Strength

	Men	Guns
Infantry	1,968,321	
Cavalry	273,703	
Artillery	487,673	5606
Other arms and departments	262,180	
Additional trained men	2,970,429	
Total	5,962,306	5606

Composition of the Army

1st, Active Army.	3d, 2d Reserve.
2d, 1st Reserve.	4th, Militia.

The population (census 1909) is 166,107,700.

Budget, Military (1912), $296,274,825.

—Army—Supply and Transport

See also

MOTOR TRANSPORT—RUSSIA

—History

See also

EUROPEAN WAR

GREGORIVITCH, GENERAL MICHAEL

[Military Operations of the Empire. *Voenny Sbcrnik,* Dec, '16. 5000 words and one sketch.]

(This article is an account of operations undertaken in 1863 and 1864 by the Russians in Central Asia and is a mere recital of events, without discussion of the facts set forth, and has consequently only historical interest. As the theater of operations and the forces and individuals acting therein are all equally unknown to American readers, a review of this article would be of little or no value. No special points of interest are brought out.)

[The Central Asiatic War. By A. Sh—sky. *Voenny Sbornik,* Jan, '17. 5000 words.]

This article is an account of the Russian campaign in Central Asia in 1864. The description is given principally in the form of a diary, in which are noted strengths and movements of troops, names of commanders, and results obtained. Without a map, or acquaintance with the people mentioned, the account is of value only for reference purposes.

[Military Operations in Central Asia. By A. Sh—sky. *Voenny Sbornik,* Feb, '17. 5000 words.]

A rather detailed account of the military operations of the Russian army in central Asia during the years 1864 and 1865; covering principally the second expedition against Tashkent. The statements made of operations are supported by references to the source of information, and the article appears to have been carefully written. However, as no map accompanies it, and the topography, etc., are little known in this country, the account is of little interest to our readers.

[Idealism. By Lieut.-Colonel A. C. Yates, F.R.G.S., R.H.Hist.Soc. *United Service Magazine,* June, '17. 3200 words.]

(A resumé of Russian history in the past few months.)

[The Agrarian Question. By A. B. *Weekly Naval Review* (*Russian*), June 7, 16, and 30, '17. 1600 words.]

(Note.—The Weekly Naval—or Marine—Review (Eshenedilinek Marskova Sbornik) is a new Russian periodical, the first number being dated June 7, 1917. It is socialistic, a product of the revolution, and is published by the sailors of the Baltic fleet.—ED.)

The agragrian question is intimately bound up, and is one of the principal causes of the Russian revolution. A knowledge of this question is essential to a correct understanding of what is passing in Russia.

In every 100 people in Russia, 74 live in the country, and 26 in towns. At present those who live in the country have insufficient ground for cultivation. Only about 35.1 per cent of the ground available for cultivation is actually so used. The balance is in public lands; imperial preserves, church lands, etc. Many persons are consequently inclined to believe that the agrarian question can be easily settled by a redistribution of these unused lands; but evidently an intimate knowledge of the suitability of the land is necessary. (Opions of various persons are quoted as to the amount of land immediately available in various provinces of Russia.)

At the present time the number of families in Russia on farms is approximately 14½ million. Of these, about 2,900,000 own farms of 10 acres or less;

5,100,000	" " " 10 to 20 acres;
2,200,000	" " " 20 " 30 "
1,900,000	" " " 30 " 100 "
200,000	" " " more than 100 acres.
2,200,000	" no land of their own.

In substance what the Russian peasant needs is sufficient land; financial assistance from the state and instruction in intensive cultivation. Tables are shown, indicating that the average yield of grain in Russia, of all kinds is about one-third that ordinarily obtained in the United States.

—Military Policy of

[How the War Can Be Ended. By L. Bulanov. (Social Revolutionary Committee, Petrograd, 1917.) 4500 words.]

The war has now lasted three years. Hundreds of towns and thousands of villages have been destroyed; millions of lives have been lost. How can this war be

RUSSIA—Continued

ended, and peace brought to all? In order to clearly understand this matter, it will be necessary to review the causes of the war.

The war was started by Governments controlled by non-working classes of capitalists, owners of factories, wealthy individuals, etc., who were not contented with what material wealth they already had, but desired more. Among these Governments was Russia, which was controlled by powers in which the people had absolutely no voice at all. It was this Government which was responsible for the unfortunate war with Japan, in which we lost our fleet, a hundred thousand lives of our soldiers and greatly increased our debts. After Russia, Germany and Austria, and particularly Germany had Governments controlled by non-working classes at the head of which Governments were two emperors who between them initiated and started the present war. The first blow fell upon little Serbia. Now the Austrian-Hungarian empire is composed in large part of nations other than Germans and Hungarians, *viz.:* Serbs, Rumanians, Poles, Tcheks (Bohemians), Italians and Ruthenes. As frequently happens in such cases these foreign peoples were principally composed of peasants and workmen, and they were more or less interspersed with the ruling races. It was one of these peoples, an Austrian Serb, who murdered the Austrian crown prince, and gave an excuse for the declaration of war against Serbia. Then Russia, certainly not on account of any sympathy for the Serbs, but on account of its desire to retain the leadership of the Slav races in the Balkans, which it had held since the days of the Turkish era, mobilized its army, which event was followed by a declaration of war from Germany against Russia, and against France, the ally of Russia. In this manner began a bloodly war, in which Turkey and Bulgaria joined Germany; and first France, then England, Japan, Italy, Rumania and finally the United States, joined Russia.

Germany had foreseen and wished for this war, and had made for it the greatest of preparations; extraordinary accumulations of guns and munitions had been provided. At the commencement of the war Germany made its first attack on France, ruthlessly moving its great, prepared army thru neutral, helpless Belgium, on the poorly defended French northeast front, devoid of fortresses, and thereby avoiding the main French forces, which were in general, massed on the eastern frontier, where they were in addition assisted by fortresses and mountain ranges. Within 2 or 3 weeks all Belgium except a small portion had been seized and occupied by the German hordes and enormous contributions exacted.

France and England, and subsequently the United States entered the war with the free will of the working classes, for with their form of governments it would have been impossible for these nations to have made a declaration of war without the consent of their peoples.

The English fleet, the largest and best in the world, has since the beginning of the war confined the German fleet to its harbors, seized the German colonies, and so thoroly blockaded Germany that a serious shortage of food, metals and other raw materials has occurred in Germany, materially affecting their prosecution of the war.

How can the war be brought to an end? As the Russian people at the present time are fighting solely for their liberty, the Congress of Workmen and Soldier Delegates have adopted a resolution that the Russian people were opposed to any annexations of territory or to any contributions, but desired the freedom of all nations. The Delegates invited the German and Austrian people to overthrow their emperors, bankers and other monied classes who had control of their governments. With regard to the annexation of Turkish Armenia, Galicia and Bukowina to Russia, the Delegates were opposed to any such annexation, unless desired by the freely expressed will of the inhabitants of those countries.

At the present time the German alliance has conquered Belgium, northern France, Serbia, Montenegro, part of Rumania and 16 Russian provinces having a population of some 20,000,000. All offers of peace so far have come from the German alliance. The people of Germany and Austria apparently lack either the will or the strength to overthrow their imperial governments.

What solution is therefore left to us? Undoubtedly Germany would conclude a separate peace with us if we were willing, but she would exact a large contribution. This as what the government of Czar Nicholas intended to accomplish, for by failing to provide food and munitions for the Russian armies the latter had come to such a condition, that soon, willingly or unwillingly a separate peace would have been forced upon the country. Can we afford to make such a peace now? Serbia, Belgium, France and other countries came at the hour of need to the assistance of Russia, and we can not now abandon to their fate these countries which have done so much for us. Had France and Belgium not taken the brunt of the German attack in 1914, and had not the British fleet blocked the German fleet in their harbors, what would have happened to us? A separate peace is out of the question.

Just now the French, British and Italians are conducting an intense warfare upon their respective fronts, and to meet these attacks the Germans have withdrawn troops from our frontier. If we would only attack upon our own front simultaneously with our allies it is fair to presume that we would have an opportunity to overthrow the German armies. Let us, therefore, boldly adopt this policy, and with all our strength come to the assistance of our allies and with them join in a general attack upon the Germans and force them to accept a peace from us. Prior to present times the Rusian people had no direct interest in the war, but now as representatives of a free Republican Government we have great interest and we must fight in order that our interest and the freedom of nations may continue.

[Russian General Order (extract); by Kerensky, Minister of War and Marine. *Weekly Naval Review* (*Russian*), June 7, '17. 400 words.]

12 (25) May; 1917.

To All Military Officers, Soldiers and Sailors:

I address you as representative of the people and of the revolution. All you, free sons of Russia, from soldier to general, will turn to the great ideals of the revolution—freedom, equality and brotherhood. Do not allow a single drop of your blood to be shed for any wrong. You will attain at the points of your bayonets your ideals; moving forward together and with discipline; for without discipline nothing can be accomplished. Let strength succeed to weakness in our free army and navy; and let new discipline be established in the railroad service. Remember that he that goes backward loses all. Heavy will be your burden, but proudly will you bear it.

This order will be published to all companies, squadrons and batteries, and to all naval commands.

(Sig.) KERENSKY.

[Russian General Orders. *Weekly Naval Review* (*Russian*), July 7, '17. 250 words.]

General Order for Army and Navy No. 18.

9—(22)—July, 1917.

(Extract Summary.)

Before me there has appeared a delegation of soldiers from the 2d Caucasus Grenadier Regiment who submitted an inquiry as to whether or not they were required to obey the orders of their military superiors as to matters relating to military operations, or preparations for military operations. If so they desired to know whether it did not follow that all orders for fighting should emanate only from my headquarters. Other similar questions were asked.

In reply I announce that all military officers on duty, appointed or continued in office by the new Revolutionary Government, have full authority to issue orders for all military operations, or preparations for such operations. And all orders so issued must be obeyed as orders issued under my authority, or the authority of the Provisional Government.

* * * * * *

(Sig.) A. KERENSKY.
Minister of War, and of the Navy.

—Railroads

See

RAILROADS—RUSSIA

RUSSO-TURKISH WAR

—Cavalry, Use of in

See

CAVALRY—USE OF IN RUSSO-TURKISH WAR

SABER

See

CAVALRY—ARMS—SABER

SADDLES

—Pack

[The Schaller Jointed Pack Saddle Model No. 7. By Major Pedro Obregón Matti, Spanish Military Attaché in Vienna. *La Guerra y Su Preparación*, Jan, '17. 1000 words. 23 photographic illustrations.]

(This article is a description of the new pack saddle and pad recently adopted by the Austrian army. It has been given a thoro test on animals of all sizes and carrying all kinds of loads. The results were very satisfactory, for after long, continuous marches, carrying machine guns and other heavy equipment, there was a complete absence of sore backs.)

ST. ALBANS, Battles of

[The Two Battles of St. Albans. By Percy Cross Standing. *United Service Magazine*, Dec, '16. 2400 words.]

(Historical sketch.)

ST. ELOI, Battle of

[An Incident on the Western Front. By Arnold Whitridge. *National Service*, Apr, '17. 3200 words. One sketch.]

(Editorial Note: The author enlisted in the English army, was later commissioned in the Royal Field Artillery, and served at the front continuously from Apr, 1915, till the autumn of 1916, chiefly in the Ypres salient and on the Somme.)

In the present war there are no clearly defined battles. Opposing armies suffer and inflict enormous casualties, but neither is destroyed, nor is contact with each other lost. The Battle of St. Eloi in March, 1916, was no exception. At St. Eloi—a village near Ypres—it was decided to straighten the line by attacking a small salient in the German line which had been a source of annoyance. The preparation for the assault was to be the explosion of six mines under the position instead of the usual artillery bombardment. The mines were to be set off at 3:14 a. m. and the Royal and Northumberland Fusiliers were to assault the position sixty seconds later. The explosion of the mines was to be the signal for the artillery to put up a barrage of fire on each flank of the attacking troops and along the German support trench about a hundred and fifty yards in rear.

The mines were exploded and the German defenses wrecked. At the same moment nearly two hundred pieces of artillery concentrated a ring of fire around the German position. The Northumberlands succeeded in taking the right half of the salient, but the Royal Fusiliers were unsuccessful on the left, due to the failure of two of the mines to explode. The German artillery opened fire immediately at the beginning of the attack. St. Eloi was completely wiped out. Towards evening the artillery slackened off. Three guns of the author's battery had fired 1200 rounds.

During the next forty-eight hours the English surrounded the fourth crater on three sides, leaving the garrison only two communication trenches in the one hundred yards of the fourth side, and this covered with a continuous barrage of artillery fire. The King's Liv-

ST. ELOI, Battle of—Continued

erpools, which had relieved the Royal Fusiliers, would at intervals try to rush the position, but invariably failed.

Two courses were open, one to starve, and the other to shell out the garrison. The first was too costly in ammunition and the latter presented its difficulties—the proximity of the other craters occupied by the attacking troops, ground so altered by the explosions as not to be visible from old observation posts.

An old crater in No Man's Land fifty yards from the point of attack was chosen as the new observation station. In rear of the first line trenches the telephone line of the artillery had been completely destroyed by the German artillery fire, necessitating the use of the infantry's cable to brigade headquarters. This was objectionable as they might cut in on the line in the middle of the ranging fire. However, a new line had to be run from battalion (infantry) headquarters to the observation point selected. To do this the author and one orderly had to crawl along the bottom of disused communicating trenches which had evidently been marked by German snipers. To their surprise they found the crater occupied by a platoon of infantry, who welcomed them tho they were the harbingers of artillery fire at a target only fifty yards away by guns which had exceeded their supposed life by several thousand rounds.

Communication was gotten with the battery and the guns ranged in the crater in four shots. The next morning the infantry took the position with little loss, capturing thirty-six Germans.

The Germans recaptured the modified position about a week later. Such engagements show they are not worth the ammunition and lives expended.

SANITARY SERVICE

See also
Bath trucks
Baths
Hospitals
Latrines
Red Cross Society
Surgery, Military
United States—Army—Sanitary service
Veterinary service

[Sanitary Troops in the Balkan Armies. By Lieut.-Col. D. Arturo Sola, Spanish Military Attaché to the Balkan States. *La Guerra y su Preparación*, July, '16. 2100 words.]

(This report, which is of particular interest to army medical officers, is a description of the formation, organization, training and *modus operandi* of the various sanitary units of the Serbian, Bulgarian, Turkish, Greek and Rumanian armies.

Stress is laid upon the fact that the success of these units is due to the prompt and efficient mobilization, in case of threatened hostilities, of the civilian doctors and surgeons and also other persons who may have any knowledge of medicine or surgery. Nearly all of these individuals are members of the Reserve Corps in time of peace.)

[The War and the Hospital World. Editorial. *Modern Hospital*, June, '17. 1500 words.]

No editorial comment has hitherto been made concerning the war, because the daily papers are in a better position to get the news than monthlies; because the preparations were in excellent hands, and the less said the better, particularly as only incomplete information is at hand and comment based upon it might be misleading; because comment might accentuate a tendency to hysteria; and because the time has come to work instead of talk.

The things already done concerning the war which are of special interest to hospital people are:—action thru the National Council of Defense and a special committee to standardize hospital and medical supplies for the war; vast quantities of supplies have been bought and far greater quantities tentatively arranged for, so that the producers of these supplies can be counted upon to meet the requirements; the hospitals of the country have been mobilized and can be counted upon to do their part; a vast number of hospital units have been created in all parts of the country thru the agency of the American Red Cross, and under the direction of Col. J. R. Kean, Med. Corps, U. S. Army; some of these units have been on a basis of the regulation base hospital, with a personnel of 196 men each, of whom 25 are physicians, surgeons, and specialists; six of these units have been called for work in France and will soon be at the front; smaller units have also been created, some of these of physicians only, to meet the need for approximately 5000 medical men for the various battle fronts, and these are going forward as rapidly as training and transportation will permit.

The medical profession has responded splendidly to the call for military service. When the army of one to two million men is an actual fact, the producers of hospital supplies and the medical profession will have done their part toward the equipment and professional service for this vast force.

Chile

See
Chile—Army—Sanitary service

—Establishments—Hospitals

See also
Hospitals

—History

[The Coat of Arms of the Medical Corps. By Lt-Col. C. C. McCulloch, Jr., U.S.A. *The Military Surgeon*, Aug, '17. 5000 words. 1 illustration.]

(An investigation of the history and significance of the coat of arms of the Medical Corps, with some general remarks on the bearing of arms.)

—In European War

See
European war—Sanitary service

—Instruction and Training

See also
Chile—Army—Sanitary service

—**Medical Supplies**

See also

Flavine

[Preparation of Drugs for Supplying the Army. By A. Stuchhi, Army Pharmacist. *Rev. del Circulo Militar,* Feb, '17, 1500 words.]

The enormous demand for drugs to meet the sanitary needs of the armies now fighting in Europe, together with the blockade which has cut off our usual sources of supply, has occasioned a great scarcity in our markets.

To meet this situation steps should be at once taken to insure a proper supply for our own army; fortunately the necessary raw materials are available and the technical knowledge for their preparation; it only remains to provide sufficient laboratory facilities and turn our energies to this work at once.

Something has already been accomplished in a small way in this matter by improvised methods, but to insure an adequate supply our laboratories should be enlarged and properly equipped.

The expense involved in this undertaking would be more than compensated by the saving made in one year of production. Not only would this be an advantage in an economical way but it would be a step toward securing our independence of foreign manufacturers; it would also be of great benefit in increasing the scientific knowledge of our corps of pharmacists and their value in time of war in the manufacture of powder and explosives.

(Here follows descriptions of method used by the author in preparing formaline.)

—**Military Functions of the**

[Co-ordination between the Medical Services and the Combatant Branches of the Army. By Col. T. H. Goodwin, R.A.M.C. *Military Surgeon,* Sept, '17. 3600 words.]

(An address delivered before the Army War College at Washington. After the address are printed about 2000 words of discussion and answers to queries propounded to the lecturer.)

The British Field Service Regulations give the functions of the medical service of forces in the field as follows:

1. The preservation of the health of the troops.
2. The professional treatment and care of the sick and wounded.
3. The replenishing of medical and surgical equipment.
4. The collection and evacuation of the sick and wounded from the theater of operations.

The object of a commander in the field is to win a campaign as rapidly and decisively as possible. The functions of the medical service may be summarized as follows:

"To insure, by every means in its power, that the commander of the forces is kept constantly supplied with the fighting men he requires, and that all medical operations conducted with this purpose in view are so carried out as to interfere as little as possible with the military operations."

Medical men are a little prone to overlook the fact that the military medical service exists primarily in order to assist the commander of the forces to carry out his intentions successfully. The second and third of the medical functions laid down in the British Field Service Regulations mentioned above should be so conducted by the medical service as never to bother the combatant branches. Only the first and fourth functions will, therefore, be considered.

The preservation of the health of the troops thru sanitary organization of the army is of intimate concern to all officers. The military authorities very properly look upon the matter from the military standpoint, possibly not exactly the same as that of the medical authorities. All believe, however, that the efficiency of troops in the field is largely dependent upon adequate sanitary precautions. Officers thruout the service consequently do all in their power to insure the carrying out of sanitary regulations. The good effects are most noticeable when sickness in past wars is compared with what has occurred in this. The sanitary efficiency of a unit is found to be a direct index to its military value.

If sympathy and co-operation between the combatant staff and the medical authorities are necessary in sanitation, they are equally so in the evacuation of the sick and wounded from the theater of operations. This, again, is a matter of great importance from a military point of view. It has often been noted with what extreme relief and satisfaction a division commander has received the word that all casualties have been collected and evacuated, and that the field ambulances and clearing stations are ready to cope with what may be expected in future attacks.

The arrangements for the clearance of a battlefield of its wounded during and after an engagement require a very great deal of careful thought and management. The medical officer must decide as to where his advanced and main dressing stations will be best situated, by what communication trenches, or other lines, the stretcher bearers can bring the wounded to the rear, to what extent field railways can be utilized, what roads will be available for ambulance wagons, what accommodation is available in the casualty clearing stations, how far forward will the ambulance trains come, what roads will be available for the motor ambulance convoys, what number of casualties may be expected, etc., etc.

In making his arrangements he must always bear in mind that military operations must not be interfered with. For instance, the motor ambulance convoys must in no way interfere with the bringing up of ammunition or other supplies.

In order to do all of this effectually, it is imperative that he be kept informed as to impending operations and changes in existing operations as they occur. It is also essential that the staff officers of the organizations should have a knowledge of the medical services of their units, of their requirements, and of their methods of working. Often when we hear of the breakdown of medical arrangements it is not the fault of the medical officers. They have not been kept in-

SANITARY SERVICE—Continued

formed of impending operations and so given an opportunity for making adequate arrangements.

The efficient carrying out of medical arrangements reacts on the military value of the fighting troops. In order that these arrangements may have a reasonable chance of success, a close, sympathetic co-operation on the part of the headquarters staffs of the various units with their medical staff is a *sine qua non*.

—Naval Medical Service

[The Lot of the Wounded Sailor. By Surgeon Horace E. R. Stephens, M.B., R.N. *Jour. Royal United Service Institution*, Feb, '17. 5000 words.]

Before August, 1914, there had been little experience in handling wounded on board naval vessels. The matter had been carefully considered, but there had been no actual experience. Much had been learned from the Japanese experience in the Russo-Japanese war.

Probably the most important duty of the medical officer is to keep wounds clean and prevent sepsis. The Japanese required all officers and men to wash themselves thoroly and don sterilized clothes before going into action. The later Japanese ships had increased facilities for this purpose. The result of this precaution was a striking diminution in the extent and severity of suppuration.

Our plans and methods have stood the test of this war well. Thru the ability and great labor of Sir James Porter and his successor, Sir Arthur May, the present Director-General, the expansion necessary to provide the vast fleet with adequate and efficient medical supervision has been successfully carried out.

The conditions necessarily incident to caring for the wounded in battle on shipboard are chiefly responsible for the difficulties and hardships, and no approach to shore ideals is possible. The prime object of a ship is to fight and she is designed with this purpose in view. Accommodations of every description, both quarters and stowage, are secondary. The sick bay cannot be placed in the best situation as regards light, ventilation, etc. Later ships show much ingenuity in providing the best possible accommodations. The present article considers naval vessels only.

The battleship and battle-cruiser each carry three medical officers and about a half dozen orderlies. The armored cruiser usually carries three medical officers and three or four orderlies. The light cruiser has two medical officers and three orderlies. The destroyers carry one medical officer and one orderly. These ships vary from steady to the extreme reverse from the medical standpoint of caring for the wounded.

The sick bay is close to the upper deck as a rule, but owing to its exposed location is not used in action. In action the medical personnel is stationed below in the best shelter the vessel offers, but experience shows that there is no absolutely safe place on board. Each ship is now provided with two medical distributing stations, so that the whole personnel and matériel will not be destroyed at one time.

The distributing station should be behind and below armor, accessible from the upper deck or mess deck where casualties most commonly occur, well ventilated, and the accommodations should be ample.

During war these stations are always partially ready. Surgical instruments are laid out and sterilized and materials for bandages and dressings arranged convenient for use. A hot water tank is arranged. A free supply of both hot and cold water is very important.

Three methods of lighting are employed—the usual electric system, liable to interruption in action; oil lamps, liable to be extinguished by concussion; and flashlights. The latter is the most reliable. In fact, a flashlight and a supply of morphia are two indispensable items for a medical officer.

The ventilation of a ship is difficult, but the danger from the fumes of exploding shells makes good ventilation imperative.

The first aid parties comprise those officers and men not required for other duties in action. They are given a course of instruction with a view of fitting them for first aid work. They carry bags containing dressings, bandages, etc. Stretcher parties are detailed from those not otherwise required.

The stretcher in general use has sides that fold over and are secured by wide straps, thus enabling the patient to be lashed in securely. A ring at each end permits lowering or hoisting either in horizontal or vertical position, the latter being often necessary on shipboard. Canvas chutes are also used for lowering the wounded.

At the beginning of an action, the duty of a medical officer is the trying one of waiting. Casualties occur and the endless task begins. During the action the wounded are usually placed near where they fall. The medical officers must remain in their shelters until a lull or the conclusion of the action offers an opportunity to work. Their duties are:

1. To save life.
2. To alleviate pain and suffering.
3. To mitigate sepsis.
4. To remove the wounded to a place of safety.

The great standby is morphia, usually administered hypodermically. All the wounds are dirty, presumably septic, and require the most careful treatment. Hemorrhage is less than would be anticipated. Burns are of distressing frequency. First aid consists in applying wet picric acid dressings, and recently a paraffine wax "ambrine" promises to be of great value.

After the action, a considerable time—possibly several days—may elapse before the base is reached. The best place available is utilized for the wounded. Much depends upon the state of the weather and the sea. Only urgent major operations are attempted. The energies are devoted to sterilizing the wounds, arresting hemorrhages, necessary amputations, but other operations are rarely attempted.

On arrival in harbor the wounded are sent ashore as quickly as possible and coaling commences. Even the most lightly wounded are put ashore.

The hospital ships, replete with every convenience, are ready to deal with emergencies. The average can

deal with about 300 cot cases. When filled, they proceed to one of the bases provided with a Naval Hospital.

—Organization

[Importance of the Zone of Supplies from the Point of View of the Military Sanitary Service. By Pio Isaac Acuna, Lieut-Col. and Division Surgeon. *Rev. del Circulo Militar,* Sept, '16. 4000 words.]

The zone of *etapas*—or supply—lies between the zone of operations and the zone of the interior. Within this zone, echeloned from front to rear, are certain sanitary formations whose duties in general are to provide all medical personnel and supplies for the troops, and to evacuate the sick and wounded to the base hospitals in the rear.

The entire success of the sanitary service depends upon the proper organization and functioning of the services in this zone, and this in turn requires careful study and preparation in time of peace.

No hasty improvisation of means, methods, or facilities will suffice, and any deficiency in organization, matériel, or personnel will bring about increasing confusion and disorder and the ultimate collapse of the sanitary service.

If the sanitary formations are not properly disposed along the lines of communication, or, if there is a shortage of hospital trains or other means of transportation, a check or halt in the movement of the sick and wounded is sure to result.

If sufficient storage accommodation has not been provided for reserve supplies, these will begin to pile up and soon get out of hand.

The quality and hygienic condition of the medical supplies is important. These should reach the front sterilized and ready for use. Otherwise many lives will be sacrificed.

An important factor in this zone is the operation of the civilian aid societies. In time of peace the military authorities should keep in touch with the various societies for the care of the sick and wounded, their capacity and resources should be known, and they should be instructed in their duties in the field.

[Sanitary and Veterinary Services of a French Regiment of Cavalry. By Col. D. Juan García Benítez. *La Guerra y Su Preparación,* Mar, '17. 300 words.]

The fact that there is little movement of troops permits the carrying out of the veterinary and sanitary services almost as in time of peace. Each regiment of a cavalry division has two medical officers and one non-commissioned officer; each squadron has one non-commissioned officer. In regiments belonging to army corps there is in addition a reserve medical officer. In addition to the individual first aid packets, each attached enlisted man of the sanitary service carries a number of additional packets; each regiment has two carts, each of which can carry two wounded, and each of which carries a medicine chest.

Each divisional regiment has two veterinarians and each squadron has four horse-shoers. Each regiment of an army corps has in addition a reserve veterinarian.

[The Care of the Wounded and Their Evacuation. By V. Zamrshetsky. *Voenny Sbornik,* Apr, '17. 5000 words.]

[Note.—This article relates to position warfare only.]

The first provision for care of the wounded is the first aid packet, which is or should be in the possession of every officer and enlisted man. All should be carefully taught how to use the package.

The next provision is the establishment of company, battalion and regimental first aid dressing stations. Company stations are in charge of a non-commissioned officer; battalion stations have a non-commissioned officer and in addition a junior medical officer. The location of these stations and the routes to be used in reaching them must be made known to every member of the command. These stations are equipped to apply bandages, arrest hemorrhages, perform emergency operations, etc.

The regimental stations are established in specially constructed dugouts or protected houses, and are small hospitals with facilities for sterilization and the usual necessary equipment. A complete record of cases is kept at these stations.

Main dressing stations are established for each division, and should be located beyond the zone of fire, at least 5500 to 9000 yards from the front line trenches, and not within one-half mile of any battery. These stations are equipped for all kinds of surgical work, for furnishing hot food, and for evacuating the wounded. Of two such stations in a division, one is specially assigned to surgical cases requiring operating, and the other to medical and lightly wounded cases.

Each of the main dressing stations must be furnished with ample facilities for evacuating the wounded, consisted of auto-ambulances, hand carts, and a special transport of not less than 75 wagons. In winter, provision must also be made for keeping the wounded warm while undergoing transportation to the rear.

Before each engagement the chief surgeon of the army submits a plan of evacuation, which plan covers the location of all dressing stations; the lines of communication to and from these stations; the marking of routes; and the evacuation of the wounded to the rear by railroad or other transportation. This plan, when approved, is furnished to all division and regimental surgeons.

—Preventive Measures—Disinfection

[Note. *Army & Navy Jour.,* Mar 10, '17. 150 words.]

Six clothing disinfectors of a new portable type, the invention of a New York doctor, and similar to those in use in Europe, have been purchased for the United States Army. Each machine can disinfect 50 uniforms and kits in 40 minutes. The outfit includes a five horsepower upright steam boiler connected by piping

SANITARY SERVICE—Continued

with an airtight chamber six feet long and 34 inches wide. In the rear end of the chamber is a heavy door which can be hermetically sealed. A rack for clothing slides into the chamber. Smaller articles are laid on a grating. The outfit can be moved either by horses or by being attached to a truck.

—Transportation of Sick and Wounded

See also

DOGS—SANITARY SERVICE

—Transportation of Sick and Wounded—Hospital Trains

[Army Hospital Trains. *Review of Reviews*, Dec, '16. 1700 words. Illustrated.]

Before the European war started, there were a few hospital trains in existence. Now there are hundreds, and the resources of science and engineering have been drawn upon to make the transportation of sick and wounded hygienic and comfortable.

French and British hospital trains usually consist of sixteen cars. One model German train has twenty-nine cars. About half of the cars are for wounded, the remainder for auxiliary services. The train crew is seldom less than thirty. The number of wounded per car varies from twelve (Great Eastern Hospital Train) or fourteen (Bavarian) to as many as thirty-two (some French cars). Wounded are carried in suspended stretchers. This obviates changing from stretcher to bed, and permits means for avoiding jolting.

For several months the United States has had approximately 150,000 troops on the Mexican border. Inoculation has eliminated epidemic disease, but there is still a considerable aggregate number of sick. Hospitals of 150 beds each were established at nine points along the border. Hospitals for 350 to 500 patients were established at Brownsville, Tex., and Nogales, Ariz., and base hospitals of 750 beds at San Antonio and El Paso, Tex.

A hospital train designed jointly by Maj. P. L. Jones, Medical Corps, and Mr. Phlager of the Pullman Co., is used to carry the sick north to the general army hospitals. The train is of ten cars: 1st kitchen; 2nd and 9th, sitting patients; 3rd, 4th, 6th and 7th, litter cases; 8th, recovery and baggage rooms; 10th, nurses and attendants.

—Transportation of Sick and Wounded—Motor Ambulances

[The Standardized French Ambulance. By W. F. Bradley. *The Commercial Vehicle*, July, '17. 1900 words. Illus.]

The standardized type of field ambulance adopted by the French armies is a 15-hp. Fiat carrying five stretcher cases or eight sitters. The motor is a 4-cylinder block type, 3.14 by 5.5 in., 171 cu. in. piston displacement. It has shaft drive, four speeds ahead, and is equipped with steel disk wheels carrying pneumatic tires 32 x 4½. Two spare wheels are carried.

The body is all-wood of one thickness of planking which is dovetailed to give a smooth inside finish. The interior is painted and varnished white.

There are two longitudinal seats, completely boxed in, with imitation leather cushions and back rests. Four lockers built under the seats, one at each corner of the body, open to the outside and provide storage places for tools, oil, etc., and the driver's kit. The center space under the seats is occupied by the rear wheels, the body being the full width of the chassis and undercut for the wheels.

The body is divided down the center by two pairs of steel tube rails attached to the front body panel and to a vertical bar hung from the roof at the rear. There are two similar rails on each of the sides of the car and one in front of each seat, going under the men's knees when sitting cases are carried.

"On each of these rails is mounted a grooved pulley and an endless girth with a coil spring attachment, also a second girth, also spring mounted, but without a pulley. The forward arms of the stretcher are passed into the pair of pulley mounted girths, the stretcher is pushed ahead, and the other two girths slipped over the rear arms of the stretcher. Two of the stretchers are very close to the roof; two others are just below, the bottom of the stretchers only just clearing the seats; and the fifth stretcher is exactly in the center, between the two seats."

This arrangement not only saves time in loading but it avoids jars to the patients. It is not necessary for any man to be inside; when the forward stretcher arms have been slipped into the girths, the stretcher can be pushed ahead with perfect ease.

The rear door is in two parts, hinged top and bottom. Fresh air can be given by opening the central upper panels on each side of the body. The glass windows at the front behind the driver admit light and allow the driver to observe what is happening inside. No attendant is carried inside.

In winter, the ambulance is heated by leading the exhaust gases thru a metal box, 8 inches wide, flush with the floor. This must be well made, as leaks have occurred which asphyxiated the patients.

The interior is lighted at night by the side lamps which are arranged with a glass disk in rear registering with a hole in the body panel. By this arrangement the driver can cover the face of the lamps when in view of the enemy, yet the interior remains lighted.

United States

[Army Ambulance Body Specifications. *Commercial Vehicles*, Sept 1, '17. 2500 words. Drawings.]

(A complete reprint of the Quartermaster General's specifications for ambulance bodies. Two types are specified: one to fit any chassis, and having a capacity of four persons prone or eight sitting; the other to fit the standard Ford chassis, having a capacity of three persons prone and two persons sitting alongside the driver. Two folding seats are provided inside the body, capacity not stated.)

[Standard U. S. Army Ambulance. *Scientific American*, Feb 17, '17. 500 words. Illustrated.]

The Medical Corps of the U. S. Army has adopted a new standard type of army ambulance, and has organized new medical units known as motor ambu-

lance companies. The new body design of the ambulances and the plan of organization of the companies were worked out by a special army board. Fifty-two vehicles of the new type have been placed in service on the southern border. These have been organized into four companies, each of twelve motor ambulances and one repair truck. The capacity of one ambulance is eight patients, seated. Four may be carried on litters. Reserve gasoline, water tanks, emergency medicines, and surgical dressings are carried in special compartments.

SAN MARTIN, General

See

CHILE—HISTORY (Article: "The Route of San Martin")

SAPPING AND MINING

See also

TUNNELS AND TUNNELING

[With the Soldiers Who Fight Underground. *Scientific American,* June 9, '17. 430 words. Illustrated.]

Mining is an old form of warfare, but the machine gun has forced a more extensive use of mining in this war as a substitute for intense artillery preparation.

Mining operations on the western front have developed into considerable engineering undertakings. Tunnels of considerable length have been driven under No Man's Land, on one occasion at least over a mile long, and craters have resulted from the explosions sufficient to contain a six-story building.

It is a game that both sides work at. Various devices have been used to detect the approach of hostile mining operations, among them a form of stethoscope and a supersensitive microphone. With them a trained listener can not only detect the hostile sappers at work, but can locate them within a few feet. Then suitable countermines are driven and exploded.

The work of the sapper is important both to the offensive and defensive. The service is hazardous, and the sapper may at any moment be blown to pieces or buried alive by the explosion of a hostile mine. Still there are plenty of volunteers, and whenever the hostile armies settle down into entrenched positions, the underground soldiers are sure to begin their work.

[Mines in Trench Warfare. By Major Ewing. *Memorial del Ejército de Chile,* June, '17. 2500 words.]

(Reprint from an article by Maj. Ewing, dated Washington, Mar, '17.)

Mines should be used in conformity with a plan prepared by the commander of the sector in which they are to be made. The commander should consult with the engineer officer of the unit.

Mines may prove convenient for the following purposes:

(a) To gain ground for an advance, forming with various mines a series of craters which are occupied immediately and connected up by trenches later.

(b) To destroy enemy trenches or buildings occupied by the enemy.

(c) To determine whether or not the enemy is mining towards our position.

(d) To recapture lost trenches.

The plan of the work should be made upon precise information of the hostile trenches. If possible this information should be based upon photographs taken from airplanes. It is advisable to secure from local sources geological information about the subsoil. Rapidity in the work is necessary both in order to surprise the enemy and to prevent him from countermining.

Grand galleries may be 300 yards in length. They should be at sufficient depth to avoid enemy countermines. Upon arriving near the objective, branches should be constructed for as many mines as are contemplated, and from these branches are constructed tubes in the form of a corkscrew thru which a man can crawl to the level decided upon for the location of the charge. Decauville tracks are used to advantage in grand galleries. The first half of a gallery should be at least 4 ft. in height, 3 ft. wide at the bottom, and 2 ft. wide at the top.

The following system has been employed successfully in dry and clayey soil: Eight sappers work for 8 hours in each gallery in parties of four men, using hourly reliefs. No. 1 excavates, No. 2 shovels the dirt back, Nos. 3 and 4 fill sacks. Detachments of infantry pass the filled sacks back to the entrance of the gallery. The average daily penetration for this party is eight yards; six yards is considered poor work. Under favorable conditions as much as 12 yards of gallery may be excavated.

An idea of the results obtained by mining may be gained from the following description of a mine constructed by the British: At a depth of 16 ft. a gallery was driven 236 ft. in length. It was calculated that the German trench was between 5 and 10 ft. only from the charge. The charge of 1000 pounds of guncotton was placed in a chamber 3 x 3 x 3 ft. at the side of the gallery and tamped with 7 ft. of packed sand bags. The result was that 80 yards of German trench were destroyed.

SCHOOLS, Military

See

AERONAUTICS—INSTRUCTION AND TRAINING—SCHOOLS

EDUCATION, MILITARY—IN SCHOOLS AND COLLEGES

—Officers' Schools

See also

STAFF, COLLEGES

SCOUTING

See

RECONNAISSANCE

SECURITY AND INFORMATION

SEACOAST ARTILLERY

See

COAST ARTILLERY

SEAPLANES

See also

AERONAUTICS

AERONAUTICS—NAVAL USES OF

SEARCHLIGHTS

See also

NIGHT OPERATIONS (Article: "Night Exercises")

SPERRY SEARCHLIGHT

[The Sperry Searchlights. Compiled by Capt. A. Gibson, C.A.C., from material furnished by the Sperry Gyroscope Co. *Jour. U. S. Artillery,* July-Aug, '16. 2000 words. Illus.]

The development of the Sperry searchlight arc has resulted from years of work, beginning with the year 1879, by Mr. Elmer A. Sperry.

The important essential of any projector searchlight lies in the arc source of light, and it has been only recently that any great advancement has been made in this direction. Up to the present time the source of light universally adopted has been the positive crater of a pure carbon arc, having a fairly constant brilliancy of 150 candle-power per square millimeter. In the Sperry arc, increased brilliancy is obtained by the use, in addition to the heated crater surface, of a superheated vapor or gas formed from certain materials with which both positive and negative carbons are impregnated.

The carbons are made smaller, and the positive carbon is consumed rapidly, necessitating longer carbons. The crater of the positive carbon is very deep. For the standard 150 ampere arc, the positive carbon is 5/8 inches in diameter and 44 inches long, and the negative carbon is 7/16 inches in diameter.

The Sperry arc has a brilliancy of 500 candle-power per square millimeter, as compared with 150 of the old arc. The 36-inch light of the Sperry Gyroscope Co. gives an illumination at the target of six times that given by the old pattern light of similar diameter.

The Sperry light has automatic electric devices for feeding and rotating the carbons, a blower to supply air to cool the carbon holders and the positive carbon; an electric device for striking the arc; as well as hand-operating devices for the above. A rheostat maintains a constant voltage across the arc of approximately 75 volts.

The vertical and horizontal training motors are arranged for two speeds, the high speed being about three times that of the slow speed. The controller is simple and is contained in a box, 3" x 3" x 5", weighing 7 pounds. A pointer on the box is kept in the direction in which the beam points. The beam moves right or left and up or down, corresponding to the movements of the controller handle at the distant station. Carbons for this light now are made in the United States.

[A Device for Giving an Image of the Searchlight Arc in Full Size Outside of the Searchlight Drum. By Capt. Adelno Gibson, C.A.C. *Jour. U. S. Artill.,* Nov-Dec, '16. 600 words. Illus.]

The essential parts of the device are: (1) A pin hole thru the side of the searchlight drum, opposite the arc; (2) a small mirror (about 2 in. x 2 in.) held in position on the side of the drum near the pin hole so as to catch the image and reflect it downward; (3) a holder attached to the tie-rod, on which a piece of cross section paper is placed to catch the reflected image.

The image projected on the paper is an excellent reproduction of the actual arc and shows how it is burning without the necessity of looking at it thru the colored glass window.

By making two marks on the paper showing the normal length of the arc when properly focused, the maintaining of a proper arc and keeping the light focused is easy.

The device affords a cheap means of observing the arc when the light is not provided with a ground glass window for the same purpose.

[More Light on War. *Independent,* Apr 7, '17. 1000 words. Illustrated.]

The Sperry searchlight, designed for various military and naval purposes, besides those of peace, is the most powerful searchlight yet perfected. It is at present in use by the navies of the first-class European powers. Its inventor, Elmer A. Sperry, also inventor of the gyro-compass, ship stabilizer, electric coal mining machinery, and the airplane stabilizer, is an electrical engineer and scientist, who was appointed a member of the United States Naval Advisory Board in 1916. Following are the main features of this searchlight:

The candle-power is more than one and a quarter billion, which enables it to illuminate a vessel until the vessel dips below the horizon. The comparative efficiency of the light may be stated thus: that the target is illuminated ten times as brilliantly as by an ordinary projector. Its effectiveness is due to small electrodes, to the special or impregnated carbons used, to the manner in which they burn, and to the large parabolic mirror reflecting the light. The voltage across the arc is about 75. The temperature of the arc is 9000 degrees Fahrenheit, which causes the carbons to give off a superheated vapor which burns in a crater of small diameter that is maintained in the positive electrode, thus adding to the beam's intensity. The carriage permits the beam to be turned to any azimuth and to ninety degrees elevation, for detecting aircraft. The light may be used for signalling up to one hundred miles.

—Aeronautical Use of

See also

AERONAUTICS—NIGHT FLYING

SIGNALLING—VISUAL—BY ILLUMINATION

[Aviation Notes. *Army & Navy Jour.,* Apr 28, '17. 70 words.]

Tests of a new and very powerful type of searchlight, designed for use in conjunction with anti-aircraft defenses, were made at the Mineola, N. Y., aviation field recently. Watchers were able to pick up an airplane two miles away and follow it without trouble. One of the searchlights in use was of 1,000,000 candle-power, with a lens sixty inches in diameter.

—Towers for

[Note. *Army & Navy Jour.*, Mar 10, '17. 200 words.]

A new type of portable searchlight tower, the invention of a Chicago civil engineer, is being tried out for use in the United States Army. The searchlight is mounted upon a steel lattice-work tower 25 feet high, which reclines along the bed of a powerful truck when not in use. It is raised in position by a winch connected with the driving machinery of the truck. Power for the 36-inch searchlight is furnished from generators in a second covered truck. The invention comprises several distinct advantages over less recent types, and its adoption is considered probable.

SECURITY AND INFORMATION

See also .

Espionage
Maps and mapping
Photography, Military
Reconnaissance
Sketching

[Service of Communication on the Field of Battle. By Capt. Andres Aguirre. *Mem. de Infantería* (Spain), Nov, '16. 3500 words. (To be continued.)]

(Extracts from Aide Memoire for Infantry Officer in campaign.)

Communication between the commander and his subordinates and between neighboring units is essential to unity of effort, and is secured by means of a trained personnel supplied with a complete and substantial equipment to meet all conditions.

Facility of rapid communication must never be permitted to restrict the initiative of subordinate officers of whatever rank or to hinder or delay tactical movements.

The means employed are: agents of communication; agents of transmission, couriers and orderlies; signals, telegraph, telephone and visual.

Agents of communication are officers, non-commissioned officers and selected privates specially instructed for this service who are employed to establish and maintain communication on the march and in battle, between their own units, neighboring commands and the next higher unit.

Communication within the regiment is maintained by cyclists, mounted orderlies, signal posts and chains of men; between regiments, corps headquarters and the artillery, by telephone.

In combat, troops of the first line will generally be limited to signal posts and chains of men.

Under normal conditions signal stations are effective within the following distances:

Without flags, 700 meters.
With flags, 1500 meters.
With flags and glasses, 2500 meters.
With signal lanterns at night, employing field glasses, 3000 meters.

Agents of transmission should be exclusively employed in carrying orders during combat; these men should be carefully selected, and have good eyesight, physical fitness, and ability to write and receive special instruction.

[Liaison. By Lt.-Col. Paul Azan. *Mil. Hist. and Econ.*, Oct, '17. 1400 words.]

We have outgrown, in the present war, the idea that liaison consists merely in the various means of placing in communication different units of one or more arms. Liaison includes to-day not only the means for getting information but the means for its transmission.

Preciseness and fullness of information constitute one of the most important factors in offensive or defensive action. There are two different phases of this, that is, during stationary fighting when the troops remain in their trenches, and during a forward movement.

Means for obtaining information are studied and prepared by officers of every rank and observing stations are established at all available places on the ground or in the air. The former have the advantage of being utilizable at all times and of being out of sight of the enemy. They must be carefully camouflaged and provided with shelters for protection of observers. Air observation has the advantage of mobility but aircraft cannot operate in all sorts of weather.

When the troops are advancing the observation stations are selected as they go forward. However, the airplanes are used more advantageously for this task and are distributed between the troops and the commander in order to keep the latter informed. In addition there are liaison agents, who are attached to small units and carry orders and news. Those attached to larger units and to the artillery also secure information. The liaison becomes most effective thru officers and non-commissioned officers sent out by the commander to keep him in touch with all movements, and thru the artillery officers and non-commissioned officers attached to infantry units to furnish information to the infantry commander and to the batteries.

Information is transmitted in many ways but principally by telephone and by wireless. With the telephone complete systems are established connecting the command and the artillery with every unit. Wireless is used for communication from airplanes to the ground.

Germany

The service of commmunication in the German army is based on the lessons of the Russo-Japanese war and the methods employed follow closely those developed by the Japanese during that war.

Visual signals (heliograph, lantern, etc.) gave such success in Southwest Africa that much attention has been given to their improvement and development since 1906 and they continued to grow in importance up to the outbreak of the present war.

Great attention is paid in the German army to the service of communication and each corps has more than 200 individuals specially instructed and employed on this duty; officers of all branches of the line are annually detailed with signal battalions for instruction.

SERBIA

—History

See also

European war

Gregorivitch, General Michael

SERINGAPATAM, Siege and Capture of

[The Siege and Capture of Seringapatam. By Lt.-Col. C. C. R. Murphy, 30th Punjabs. *Jour. United Servie Institution of India,* Apr, '17. 3600 words.]

(A brief account of the siege and capture in 1792, of Seringapatam, Tippoo Sultan's stronghold on an island in the Canvery River; and a detailed account of the second siege in 1799. The last attack opened on Apr 20 and followed regular siege methods. The assault and capture occurred on May 4. The besieging force comprised five regiments and a considerable number of native auxiliaries. The fighting during the siege and assault was severe. Tippoo Sultan was killed. The present condition of Seringapatam is described.)

SHARPSHOOTING

See also

Infantry—Fire

SHELL-SHOCK

["Shellitis": A New Malady. *Scientific American,* Dec 16, '16. 250 words.]

The French Academy of Medicine has adapted the term *obusite* to signify the physical and mental disturbances caused by being in proximity to the explosion of a large caliber shell, without being hit by any fragment. Deafness is a frequent result, sometimes due to organic lesions and sometimes to nervous shock. The latter is very often curable by appropriate general treatment. Correct diagnosis is therefore very important.

[Atmospheric Pressure Due to Detonation of Projectiles. Anonymous. *Schweiz. Zeit. f. Art. u. Genie,* April, '16. 350 words.]

An investigation of the physiological effects experienced by divers when subjected to sudden changes of atmospheric pressure, does not substantiate the assertion that persons who were neither wounded nor poisoned by gas have been killed by the atmospheric change of pressure produced by the explosion.

SHELTER

—For Troops

See also

Nissen huts

SHIPS AND SHIPPING (Merchant)

See also

Naval operations—History

Ports

[German Ships. *Memorial del Ejército de Chile,* July, '17. 450 words.]

A German nautical publication gives a list of the German ships interned in foreign ports. According to this publication the tonnage interned is as follows:

	TONS.
Sweden	3,751
Denmark	667
Holland	114,750
Belgium	84,823
Spain	180,724
Extreme Orient	58,515
Dutch West Indies	125,438
West Africa	779
North America (eastern coast)	536,006
North America (western coast)	78,177
Mexico	8,716
Cuba	23,733
South America (west coast)	336,000
Argentine Republic	54,068
Brazil	208,387
Other countries	35,849

The grand total of German ships interned in neutral ports amounts to 533, representing a total tonnage of 2,100,000.

[Two Important Steps. *Canadian Military Gazette,* Aug 14, '17. 200 words.]

* * * * * *

The U. S. Government has taken over all merchant vessels of over 2500 tons now building in its shipyards, and double and triple shifts will be used to hurry these vessels to completion, when the yards will be used for other construction. The records of the shipping board show that there about 700 vessels of nearly 2,000,000 tons now building.

—Building and Construction

United States

[Goethals to Build Wooden Ships. *Army & Navy Jour.,* Apr 21, '17. 600 words.]

Major-General George W. Goethals, U. S. Army, has been entrusted with the task of building for the U. S. Government a great fleet of wooden ocean-going merchant steamers. The plans contemplate the building of 200,000 tons a month beginning October, 1917, without interfering with the construction of steel vessels to any degree. $50,000,000 have been appropriated by Congress for this work.

—Destruction of

See also

Prize money

[Note. *Army & Navy Jour.,* Mar 10, '17. 100 words.]

German submarines sunk 490,000 tons of shipping during February, 1917, nearly one-half the amount expected by Germany. In December, 1916, 346,656 tons were sunk, and in January, 1917, 322,067 tons

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[Shipping and Submarines. *Army & Navy Gazette,* July 7, '17. 100 words. Table quoted.]

To the weekly report of shipping losses for the week ending June 24 have been added the corrected lists for the previous three weeks. All mercantile tonnage known to have been sunk is included:

	Week ending July 1.	Week ending June 24.	Week ending June 17.	Week ending June 10	Week ending June 3.
Arrivals of merchant vessels of all nationalities (over 100 tons net) at United Kingdom ports (exclusive of fishing and local craft)..	2,745	2,876	2,897	2,767	2,693
Sailings	2,846	2,923	2,993	2,822	2,642
British merchant vessels of 1600 tons gross or over sunk by mine or submarine.	15	20	25	24	15
Vessels of under 1600 tons sunk	5	6	5	10	3
British merchant vessels unsuccessfully attacked by submarines ..	11	17	37	20	15
British fishing vessels sunk..	11	0	0	6	5

SHOES AND BOOTS

See also

FEET—CARE OF THE

[A Traveling Shoe-Repair Shoe Shop for the Army. *Scientific American,* Sept 29, '17. 200 words.]

This repair shop consists of a large motor truck with trailer. The machinery is operated from the motor of the truck, while the lights are run by storage battery. The machines have a capacity for resoling 400 to 600 pairs of shoes per day. Storage space is provided for all necessary materials as well as for fifteen hundred pairs of shoes. The truck proper carries all of the machinery, while the trailer serves as a warehouse and clearing house.

SHRAPNEL

—Bullets

[Jacketed Shrapnel. *Scientific American,* Feb 17, '17. 500 words.]

A Canadian has improved the effectiveness of the ordinary lead bullets in shrapnel by crimping around it a hard and tough jacket of steel or copper-nickel. These bullets lessen the value of helmets and body cuirasses as protection against shrapnel.

—Timing of

See also

FIELD ARTILLERY—FIRE

SIBERIA

—Travels in

[Letters from Siberia. By A. Belkovich. *Voenny Sbornik,* June, '16. 2400 words.]

(A narrative of the author's travels in Siberia, relating his experiences in that country. This article has no value from a military point of view.)

SIDERURGY

See

STEEL—USE OF IN THE MANUFACTURE OF ARMAMENT

SIEGE ARTILLERY

—Maps for

[A Registration Map for (Permanent) Battery Positions. By Capt. W. A. Stirling, R. F. A. *Jour. Royal Artillery,* Aug, '16. 1000 words. 1 table.

With the very accurate maps now in possession of the British forces, "Shooting from the map" has been found to give good results.

The idea readily occurs to most gunners of drawing on the map concentric range circles, and rays from the battery position thru the zero point and at intervals of one degree to the right and left. The angle of sight to any point completes the information.

The angle of site to any point may be shown most readily by contouring a map in angles of site. At the end of the article is a table giving the difference in level in meters at ranges from 2000 to 5000 yards for angles of site from ten minutes to one degree and thirty minutes.

The contours of the map are first studied carefully, and then the zero angle of site contour is drawn, which is interpolated thruout the zone along all ground having the same height as the battery. Next, the other angle of site contours of elevation or depression are drawn at ten minute intervals, in the same manner. In very hilly ground, it may be sufficient to show the angle of site contours at intervals of twenty minutes.

SIEGE OPERATIONS

—Instruction and Training

[Italian Instruction in Fortress Warfare. By B-g. *Tidskrift i Fortification,* parts 3 and 4, '16. 4700 words.]

(In 1913 the Italian General Staff issued detailed instructions for conducting fortress warfare. These instructions consist of three parts; one pertaining to all arms of the service; the second contains instructions for the artillery and the third for the engineers.)

SIGHTS

—Rifle

See

INFANTRY—ARMS—RIFLE—SIGHTS

SIGNALLING

See also

TELEPHONY

—Electrical

See also

TELEGRAPHY—APPARATUS AND EQUIPMENT

WIRELESS TELEGRAPHY

—Visual

See also

SMOKE SIGNALS

—Visual—By Illumination

[Signalling To and From Aircraft by Means of Miniature Searchlights. *Scientific American,* Sept 29, '17. 160 words.]

SIGNALLING—Continued

The French have introduced a two-way system of communication between aircraft and the ground by means of miniature searchlights, operated by electricity and equipped with telescopes. The telescopes enable the operators to observe the distant flashes of the dots and dashes sent by searchlights with which they are in communication. This signalling equipment has a range of 10,000 feet in broad daylight, and considerably more than that at night.

SITOGONIOMETER

See

FIELD ARTILLERY—FIRE CONTROL—INSTRUMENTS AND EQUIPMENT

SKAGERRAK, Battle of

See

JUTLAND, BATTLE OF

SKETCHING

—Panoramic

See also

FIELD ARTILLERY—FIRE CONTROL (Article: "The Use of Perspectives in Batteries of Position")

[Panoramic Sketching. By Major E. H. Lovell, R.G.A. *Jour. Royal Artillery*, Aug, '16. 3000 words. Illus.]

Panoramic drawing, in some ways, is the easiest form of drawing to learn and to put into practice for producing really useful sketches. The elements must first be studied and kept in mind. These are the laws of perspective, distance, shadows, and tones.

Panoramic sketches convey a better idea of the lie of the land than maps do; heights, distances, and angles of site can be shown; ranges and important points can be marked.

The following points may be of use to beginners:

Perspective is the most important point to master. The horizontal or zero line always remains such, and is the line from which all angles of site are measured. To determine it, place a card at the height of the eye so that neither top nor bottom can be seen, then look away to the ground and see where it cuts the country. Mark it on the sketch.

Next draw the center vertical line of the sketch which line remains so; all vertical lines meeting it at a point in the distance above or below you.

All other lines, except vertical and horizontal, meet at a point in the distance depending upon their slope.

Round objects are so at all distances and angles. Oval objects will appear foreshortened or round, depending upon their positions. Square or rectangular objects appear foreshortened.

In nature the sun gives the light, and lights up only the side of the object nearest it.

There are three distances to be considered:

1. Far distance.
2. Middle distance.
3. Near distance.

The farther the distance the lighter the tone.

The usual sketching materials are necessary. The standard message book paper is most convenient, as the quarter-inch squares give about one degree at fifteen inches from the eye. To assist in measuring angles, fasten a piece of string, 14½ inches long, and with a button on the end to hold in the mouth, thru the center of the message book form.

The following order of procedure is suggested in making a sketch:

Mark the center line of the sketch and call it 0°. Angles to the left are marked left and, *vice versa*, right.

Determine the general horizontal or zero line.

Note the number of degrees from the center line to important points in the area and indicate these points by light pencil marks.

Start now at extreme distance and sketch in objects, beginning with light but clear lines, and making the lines heavier as close distance is approached. Shade the foreground very heavy.

Check objects with reference to the zero line frequently.

Draw in dotted vertical lines pointing to important objects, and note on the lines ranges, angles of site. and other important information necessary.

The position from which the sketch is drawn should be indicated by a cross.

SMALL ARMS

See

CAVALRY—ARMS
INFANTRY—ARMS

SMOKE SCREENS

See

SUBMARINES—DEFENSE AGAINST—SMOKE SCREENS

SMOKE SIGNALS

[Smoke Bombs as Markers. *Rivista di Artiglieria e Genio*, Jan, Feb, Mar, '17. 80 words.]

The German aviators use a smoke bomb for marking the location of hostile artillery. The bomb has no destructive effect, but emits a steady stream of heavy smoke. By means of this smoke as a marker the aviator quickly adjusts the fire of his own batteries on the hostile batteries.

SMOKELESS POWDER

See

POWDER—SMOKELESS—MANUFACTURE OF

[Spontaneous Combustion and the Preservation of Smokeless Powders. By Manuel A. Ditano, Col. of Artillery. *Mem. del Ejército* (Chile), Nov, '16. 5500 words.]

(A technical study of the chemical stability of the present smokeless powders and of the phenomena connected with their decomposition.)

SOISSONS, Sieges of

See

GERMANY—HISTORY (Article: Soissons, etc.)

SOMME, Battle of the

See also

VERDUN, BATTLE OF (Article: "Verdun and the Somme")

[The Battle of the Somme—Germany's Official Account. By Thomas F. A. Smith, Ph.D. *The Army and Navy Gazette* (London), Sept 9, '16. 1300 words.]

On Aug 22nd and 24th, German newspapers contained official description of the "Great Push." The following extracts from a south German paper (*Frankischer Kurier*) emanated, in the case of the first date, from "Wolff's Telegraphic Agency," the German General Staff agency for the dissemination of all official news. [In the following account, "our" means "German."—ED.]

The section chosen by our antagonists was about 40 kilometers long as a crow flies, from the village of Gommécourt, northwest of Bapaume and southwest of Péronne to Vermandovillers. The two towns formed the objective of the attack.

Signs of preparation for this attack were observed by our troops as early as May 15. Our scouts brought in prisoners and our airmen reported great activity on the part of the enemy, new railways and dugouts.

All of this permitted of no definite conclusions as to the exact force and extent of the approaching attack, because the enemy showed great activity at the same time on the rest of his front in order to conceal his intentions.

The first signs of the enemy's definite intentions were the artillery preparation on June 22. He had collected many guns, many of them heavy naval guns, on a very short section.

He also used gas shells, and when the wind was favorable waves of poison gas were turned loose over our lines in the intervals of the cannonade.

From June 25 to 30 an uninterrupted drum fire was directed against us, particularly against our first and second lines, our artillery positions, and the bridges over the Somme.

After seven days of this fire the trenches along the front to be attacked had suffered badly.

At 5 a. m. July 1 the drum fire swelled to unheard of violence along the front Gommécourt-Vermandovillers, followed by gas clouds. At 9 a. m. it was evident the attack was about to take place. The fire was directed principally on the front trenches. At 10:30 a. m. the fire was moved back to our second line, and a storm attack commenced all along the line. The enemy took some prisoners and machine guns which had been put out of action, as well as artillery of an older type. The guns had, of course, been rendered useless. The French artillery fire was directed by airmen flying at a low altitude and also dropping bombs on our trenches. Our divisions on the right wing of the southern sector had suffered greatly in loss of guns by evening, but the first day of the battle represented a disappointment for the enemy.

According to the statements of prisoners, the French and British firmly believed that the resisting powers of the defense would have been broken down by this seven days' rain of iron. On the first day of this great attack the German troops held successfully the entire northern sector up to the great road, Albert-Bapaume. To the south of this road the English succeeded in penetrating our front trenches at many points. How little these gains corresponded to the hopes of the British is obvious from an army order taken from a prisoner. According to this they were to reach the line Puisieux-Miraumont—Martinpuich on the very first day. Not even to-day, after seven weeks, has an enemy soldier reached that line except as a prisoner.

During the night, July 1-2, our artillery losses were made good as far as practicable. Many guns which had been put out of action were rescued by their devoted crews, who brought them from their abandoned positions. Infantry reinforcements were put into the positions which we still held. The second day saw a continuation of these desperate attacks. North of the Somme, the enemy gained no great success but suffered bloody losses. On the south of the river we held Estrées against terrific attacks, but the villages of Buscourt, Herbécourt, and Assevillers fell into the hands of the enemy. During the night of July 2-3, the wing division of the Army Corps at this point was compelled to withdraw to the line Biaches-Barleux.

Bitter struggles were taking place between the Somme and the Ancre. The British had succeeded on the first day in capturing our front trenches along two-thirds of the sector and had advanced to the outskirts of Mametz and Montauban. Simultaneously the French had pushed forward to the western edge of Hardécourt and occupied the village of Curlu. The success was slight, altho the enemy used many heavy guns, mines, and gas attacks. His airmen were superior and were able to direct his fire. His infantry attacks were renewed again and again with absolutely fresh troops, accompanied with a ruthless waste of human life such as hitherto we have only met with on the eastern front. Here, too, he had a surprise because his artillery had not annihilated but only hammered. Step by step with heavy losses the enemy was able to advance, because of his superior numbers, up until July 20. Since that day he has only achieved unimportant success at one single point. In the British sector too the fighting continued day and night. Larger attacks on a wide front took place on July 10 and 14. By July 6 the British had pushed their front line up to the southern edge of Longueval. Terrible battles were fought for the possession of Trônes Wood, which was taken by them nineteen times in succession and recaptured eighteen times, before they could really call it their own after the big attack on July 14.

Towards the northwest the British advanced and established themselves in Mametz Wood and Contalmaison on the 10th. The big attack which was expected on France's national day, July 14, was limited to fighting on the British front. Bazentin-le-Petit and le-Grand, as well as Ovillers, were captured.

By July 15 the British line had been pushed forward until it stretched from the southern edge of Pozières by Foureaux Wood, Longueval, Delville Wood, and Guillemont. On the 17th the remainder of Ovillers

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and la Boiselle fell into their hands. But in all essentials that has been the concluding stage of the British advance.

[French Somme Advance (Continued). The Armies. Editorial. *The Army and Navy Gazette* (London), Sept 16, '16. 350 words.]

On Tuesday, Sept 12, the French infantry assumed the offensive on a front of six kilometers from the region to the south of Combles as far as the river. This attack was begun at 12:30, developed rapidly, and in less than half an hour the whole of the German first line trenches were carried, also subsequently Hill 145, the Marrières Woods, and the entire system of trenches so far as the Béthune-Péronne road, the border of which the French hold from the southern outskirts of Roncourt as far as the point to the south of Bouchavesnes beyond the Bapaume-Péronne road. The village of Bouchavesnes was attacked towards 8 o'clock in the morning and was completely captured. During the night the French infantry organized itself on its new positions. The Germans attempted no further action. On Wednesday morning the French continued their progress east, carried by assault the farm of L'Abbé Wood, 600 yards to the east of the Béthune road.

The Germans launched counter-attacks Saturday night at different points between Belloy-en-Santerre and Barleux. Their attacks accompanied by jets of liquid flame enabled them to set foot in one of the new trenches, but they were driven out.

To the southwest of Berny, to the east of Deniécourt, and to the south of Vermandovillers, German bombing attacks led to sharp fighting. The Germans were thrown back along the entire line and suffered heavy losses. On the right bank of the Meuse, east of Fleury, a hundred fresh prisoners fell into French hands. A German attack on the positions west of the Fort Vaux road failed under curtain and machine gun fire. The effect of all this is to safeguard Fort Souville, a vital point of the French defenses on the Meuse.

[British Attack on Four Mile Front. The Armies. Editorial. *Army and Navy Gazette* (London), Sept 16, '16. 200 words.]

Notwithstanding the pressure on the western front by Marshal von Hindenburg, the British and French successes continue unabated.

On Saturday afternoon, Sept 9, General Haig attacked on a four mile front and captured the whole of Ginchy and the ground between it and Lenza Wood. This latter is important on account of the approaching attack on Combles. Counter-attacks for recovery of Ginchy failed. In the Pozières-Martinpuich sector, further ground was gained and held. On Sunday afternoon, General Haig reported that the heavy fighting of the past week had resulted in an advance on a front of 6000 yards to a depth of from 300 to 3000 yards, heavy losses inflicted on the enemy, and the strongly defended localities of Falfemont Farm, Lenza Wood, Guillemont, and Ginchy, being wrested from the Germans.

[War Booty Captured by French in the Somme Offensive. *Scientific American*, Nov 11, '16. 1200 words. Illustrated.]

The Allies claim that the main effect of the Somme offensive is not in ground gained, but in loss of men and matériel inflicted on the enemy. They point to the capture of 70,000 to 80,000 prisoners and some 400 guns, big and little. (Illustrations show captured guns (damaged), bomb throwers, and grenades. The bomb throwers are of wooden staves wrapped with wire. The usual types of hand and rifle grenades are shown. —Ed.)

[Gen. Sir Douglas Haig's Report Concerning the Period May 19-Dec 23, 1916. Supplement to the *London Gazette*, Dec 29, '16. 17,000 words. One map.]

(This is Gen. Haig's report of the fighting on the Somme. The abstract is given in considerable extension.—Ed.)

All the allies had decided upon an offensive campaign during the summer of 1916. Various alternatives had been discussed, and a complete agreement had been reached by Gen. Haig and Gen. Joffre concerning the point to be attacked. Considerable progress had been made with the necessary preparations, and the final decision as to the date on which the attack was to be made was deferred until the general situation became clearer. The attack had to be made before the summer was too far advanced, but Gen. Haig desired to postpone it as long as possible in view of the growing numbers of his command, their lack of complete training and his steadily increasing ammunition supply.

The German pressure on Verdun and the Austrian pressure on the Italian front were so heavy that there was danger that the strain might become too great. Preparations were pushed and it was agreed to launch the attack whenever conditions required, with as great a force as Gen. Haig could make available.

The Austrian pressure on Italy became so severe that the Russian offensive was launched early in June. This offensive succeeded so well that the Germans began sending troops to the eastern front, but without lessening the pressure on Verdun. The strain at Verdun became so great that Gen. Haig and Gen. Joffre agreed that their attack should not be postponed beyond the end of June.

The objects of the offensive were:

(1) To relieve the pressure on Verdun.

(2) To prevent the transfer of German troops to the eastern front.

(3) To wear down the German forces.

On May 21 southeast of Souchez and on June 2 on the front Mount Sorrell-Hooge, the Germans made attacks intended to interfere with Gen. Haig's final arrangements for his attack. The first gained a small

amount of unimportant ground, not at that time worth the effort necessary to recover it, but the ground gained by the second attack commanded some of the British trenches and was recovered by a carefully prepared and well executed attack made on June 13. The preparations were necessarily elaborate. Vast stocks of supplies of all kinds had to be accumulated conveniently near the front. To handle them many miles of standard and narrow gauge railways were laid. Trench tramways were laid, roads repaired and new ones built, causeways laid over marshy places; dugouts for shelter, dressing stations, and for storage of material were prepared; scores of miles of deep communication trenches, assembly and assault trenches, and trenches for telephone wires were dug; numerous gun emplacements and observation posts were constructed; and important mining operations were undertaken.

There was insufficient water except in the river valleys, and many wells and borings were sunk. Over one hundred pumping plants and more than 120 miles of water mains were installed to insure adequate water supply as the troops advanced. Much of this work was done under very trying conditions, and often interrupted by fire. The weather was bad and the shelter for the troops totally inadequate.

The German "position to be attacked was of a very formidable character, situated on a high, undulating tract of ground, which rises to more than 500 feet above sea-level, and forms the watershed between the Somme on the one side and the rivers of southwestern Belgium on the other. On the southern face of this watershed, the general trend of which is from east-south-east to west-north-west, the ground falls in a series of long, irregular spurs and deep depressions to the valley of the Somme. Well down the forward slopes of this face the (German) first system of defense, starting from the Somme near Curlu, ran at first northward for 3000 yards, then westwards for 7000 yards to near Fricourt, where it turned nearly due north, forming a great salient in the (German) line."

"Some 10,000 yards north of Fricourt the trenches crossed the River Ancre, a tributary of the Somme, and still running northwards passed over the summit of the watershed, about Hébuterne and Gommecourt, and then down its northern spurs to Arras."

"On the 20,000 yards front between the Somme and the Ancre the (Germans) had a strong second system of defense, sited generally on or near the southern crest of the highest part of the watershed, at an average distance of from 3000 to 5000 yards behind (their) first system of trenches."

The Germans had worked on these defenses for nearly two years. "The first and second systems each consisted of several lines of deep trenches, well provided with bomb-proof shelters and with numerous communication trenches connecting them. The front of the trenches in each system was protected by wire entanglements, many of them in two belts forty yards broad, built of iron stakes interlaced with barbed wire, often almost as thick as a man's finger."

"The numerous woods and villages in and between these systems of defense had been turned into veritable fortresses. The deep cellars, usually to be found in the villages, and the numerous pits and quarries common to a chalk country were used to provide cover for machine guns and trench mortars. The existing cellars were supplemented by elaborate dugouts, sometimes in two stories, and these were connected up by passages as much as thirty feet below the surface of the ground. The salients in the (German) line, from which (they) could bring enfilade fire across (their) front, were made into self-contained forts, and often protected by mine fields; while strong redoubts and concrete machine gun emplacements had been constructed in positions from which" the trenches could be swept if captured. The ground favored artillery observation, and the German guns were skilfully arranged for cross fire. The whole formed one composite system of enormous strength and depth. Behind the front system several other lines had been completed, and airplane reconnaissance showed that these were being strengthened and other lines were being dug still further back.

The British trenches were parallel and near to the first line. The German front line and the ground behind were under direct observation, but the second line could not all be seen, and nothing could be seen of the more distant defenses except from the air. North of the Ancre the German defenses were of the same general character, but the observation was on more equal terms.

The fighting on the Somme divides itself roughly into three phases. The first phase opened with the attack on July 1 and closed with the operations of July 14-17, which gave the British possession of the southern crest of the main plateau between Delville Wood and Bazentin-le-Petit.

Then followed the second stage, a prolonged and severe struggle for the mastery, attended by slow and difficult progress, and ending by the first week in September with the British in possession of the main ridge and having established a fighting superiority.

Then began the third stage of pushing down the forward slopes and extending the flanks until, from Morval to Thiepval, the whole plateau and a good deal of ground beyond were in British possession. This stage closed at the end of November. Meanwhile the French, in addition to great successes south of the Somme, had pushed against determined opposition and under most difficult tactical conditions, up the long slopes on the British right and were preparing to drive the Germans from the difficult position of the main ridge between the Combles Valley and the River Tortille.

The general bombardment preceding the attack began on June 24 by a large force of artillery. Raids and bombardments were carried out at other points of the line, giving useful information as to the German dispositions. On June 25 the Royal Flying Corps attacked the German observation balloons and brought down nine of them, depriving them for the time being

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of this form of observation. June 24-July 1 gas was discharged at more than forty places over a total frontage of 15 miles.

On July 1 at 7:30 a. m., after a final hour of exceptionally violent bombardment, the infantry assault was launched. The main front of attack extended from Maricourt to the Ancre in front of St. Pierre Divion, with subsidiary attacks north of the Ancre to Serre, and at Gommecourt.

The main attack from Maricourt to Serre was made by the Fourth Army, consisting of five corps under the direct command of Gen. Sir Henry S. Rawlinson. The subsidiary attack at Gommecourt was made by other troops under Sir E. H. H. Allenby.

Just prior to the attack the mines which had been prepared were set off and smoke was discharged at many places along the front. Thru this smoke the infantry advanced steadily despite a heavy barrage by the German guns. The net result of the fighting on July 1 was the capture of Briqueterie, Montauban and the ridge to the west of Mametz, and the partial surrounding of Fricourt, La Boisselle, and Ovillers. Initial successes were attained at the Leipzig salient, and north of Thiepval, but Thiepval held and the captured ground had to be abandoned. The subsidiary attack at Gommecourt penetrated the German positions, and having gained its object the troops were withdrawn. For July 2 and subsequently the plan adopted was to press forward on the right on the front Briqueterie to a point west of Contalmaison, and to make a slow and methodical advance on the left. In order to allow Gen. Rawlinson to give his entire attention to matters on the front where the attack was to be pushed home, two of Gen. Rawlinson's corps were placed under Gen. Sir Hubert Gough, who was given command of the sector from La Boisselle to Serre, upon which he was to maintain a steady pressure.

During the first five days, in addition to the places mentioned, Fricourt (July 2), Fricourt Wood (July 2), Bernafay and Caterpillar Woods (July 3-4), and La Boisselle (July 4) were captured. From the Briqueterie to La Boisselle, over a front of six miles, the German first and strongest line had been captured, and the position penetrated to a depth of more than a mile. Four elaborately fortified villages had been captured. To the close of July 5, 94 officers and 5724 men of other ranks had been passed back.

The next few days were taken up in necessary readjustment and reliefs. The amount of progress that can be made without a pause is limited. There is the physical exhaustion of the troops, and new artillery preparations must be undertaken. This interval was occupied with secondary but heavy fighting, in which Contalmaison and Mametz Wood were captured July 10 and Trônes Wood July 13. Artillery had been moved forward into new positions as the infantry progressed.

On July 11 occurred the preliminary bombardment looking to a general attack along a front from Longueval to Bazentin-le-Petit Wood, both inclusive. In the early morning hours of July 14 the attacking troops moved out over the open for a distance of from about 1000 to 1400 yards and lined up in the darkness just below the crest and some 300 to 500 yards from the German trenches.

"Their advance was covered by strong patrols, and their correct deployment had been ensured by careful previous preparations. The whole movement without being observed and without touch being lost in any case." Thus night operations of magnitude were attempted with troops most of which had been raised since the war, a tribute to their quality. Careful preparation, forethought and reconnaissance paved the way, the latter made in many cases personally by division, brigade, and battalion commanders and their staffs before framing their detailed orders for the advance. The assault was made at 3:25 a. m. July 14, when there was just enough light to distinguish friend from foe at short ranges. The attack, preceded by a very effective artillery barrage, swept over the German first trenches and into the defenses beyond. Trônes Wood, Bazentin-le-Grand village, Bazentin-le-Petit village and wood, and High Wood were captured on July 14. Gen. Rawlinson had held a force of cavalry in readiness in anticipation of any signs of disorganization of the German forces. It was employed at High Wood. "As the fight progressed small bodies of this force had pushed forward gradually, keeping in close touch with the development of the action and prepared to seize quickly any opportunity that might occur. A squadron now came up on the flanks of our (British) infantry, who entered High Wood at about 8:00 p. m., and, after some hand-to-hand fighting, cleared the whole of the wood with the exception of the northern apex. Acting mounted in co-operation with the infantry, the cavalry came into action with good effect, killing several of the (Germans) and capturing some prisoners."

The fighting continued on a reduced scale on July 15, and also on July 16.

"The results of the operations of the 14th July and subsequent days were of considerable importance. The (German) second main system of defense had been captured on a front of over three miles," to a depth of a mile, and four more villages and three woods had been captured and held. The line was established on July 17 from Maltz Horn farm (where the French line joined), by Trônes Wood, to Longueval, then westwards past Bazentin-le-Grand, Bazentin-le-Petit village and wood, against the southern face of Pozières to the north of Ovillers. There our forward posts were occupied but not as yet securely held. Great credit is due Sir Henry Rawlinson for the results achieved and for the careful plans that made them possible."

Up to July 15 there had been captured 8 heavy howitzers, 4 heavy guns, 42 field and light guns and field howitzers, 30 trench mortars, and 52 machines. Besides the loss inflicted on the Germans, a total of 10,000 prisoners had been captured.

On the left Thiepval and Pozières were still uncaptured, but a methodical progress would here suffice. But at Delville Wood the British line formed a sharp and cramped salient, and ground had to be gained.

"The task before us was therefore a very difficult one and entailed a real trial of strength between the opposing forces. At this juncture its difficulties were increased by unfavorable weather. The nature of the ground limited the possibility of direct observation by our artillery fire, and we were consequently much dependent on observation from the air. As in that element we had attained almost complete superiority, all that we required was a clear atmosphere; but with this we were not favored for several weeks." There was more rain than usual, and when no rain fell there was an almost constant haze and low clouds were frequent.

Necessary arrangements were made for co-operation with the French. A pause was necessary for relief of troops, movement of guns, restoration of communications, entrenchment against counter-attack, and new dispositions of troops. Pressure had to be maintained on other parts of the front.

On July 18 the Germans launched a counter-attack against Delville Wood. This inaugurated a closely contested struggle that was not finally in the British favor till the capture of Guillemont Sept 3 and of Ginchy Sept 9. Pozières was captured by the British July 25. The whole of the period from July 17 to Sept 1 was marked by fierce and obstinate fighting by means of which small gains were made here and there by the British by local attacks, bombing, and sapping. These gains placed the British in a favorable position for a more general attack, which was made on Sept 3 at 12 noon, extending over the whole from Ancre to the British right. The French attacked simultaneously. Guillemont was captured immediately and consolidated. Ginchy was also seized but regained in greater part by the Germans by a counter-attack. The struggle for possession of this village continued for six days. Ground was gained north of Delville Wood and in High Wood, tho part of the latter gain was lost. Talfemont farm was finally captured on Sept 5 after three days of fighting. On Gen. Gough's front heavy fighting inflicted loss on the Germans, but little ground was gained. In the four days Sept 3-7 a front of nearly two miles was driven in to an average depth of nearly a mile, and, more important, the barrier against advance which the Germans had maintained for seven weeks was at last broken. Over 1000 additional prisoners were taken. On Sept 9 the attack was again opened on the whole front of the Fourth (Rawlinson's) Army. The German line was captured on a front of over 1000 yards northwest from Bouleaux Wood. Ginchy was captured and ground was gained east of Delville Wood and south and east of High Wood. 500 more prisoners were taken, bringing the total since July 1 to over 17,000.

Meanwhile, the French had made great progress and pushed their line forward to Louage Wood (just south of Combles), Le Forest, and Cléry-sur-Somme. The weak salient in the Allied line had disappeared and a front had been gained for further operations. The success of the assault of July 1 against carefully prepared works, followed by the successful night attack of July 14, had awakened the Germans to a sense of the power of the British attack. The depth of the defenses had secured the necessary time to reorganize the defeated troops and hurry up numerous fresh divisions and more guns. But still they were pushed back steadily and continuously and the great majority of their counter-attacks failed completely. The British new armies had shown their ability not only to storm the strongest defenses, but to make progress by steady and relentless pressure.

The British line now extended generally along the main ridge from a point about a mile east of Thiepval a distance of 12,000 yards to Leuze Wood, half-way between Guillemont and Combles. In front of the junction between the French and British lines lay Morval, a strong and commanding position, and the French progress against Sailly-Saillisel was hampered by the topography and by the extensive St. Pierre Vaast wood. On the left Thiepval, which may fairly be described as being as nearly impregnable as nature, art, and the unstinted labor of nearly two years could make it, was still uncaptured. The plans of July 1 had been such that its immediate capture was unnecessary. The time was now approaching when this task must be accomplished. The Wonder Work was captured by a highly successful enterprise on the evening of Sept 14.

"The general plan of the combined Allied attack which was opened on the 15th September was to pivot on the high ground south of the Ancre and north of the Albert-Bapaume road, while the Fourth Army devoted its whole effort to the rearmost of the (German) original systems of defense between Morval and Le Sars. Should our success in that direction warrant it (Gen. Haig) made arrangements to enable (him) to extend the left of the attack to embrace the villages of Martinpuich and Courcelette." When Morval was reached the time would arrive to swing the left across Thiepval ridge. The French were to continue to advance in co-operation, directing the main effort against Rancourt and Frégicourt to isolate Combles and open the way for an attack on Sailly-Saillisel. The preparatory bombardment began at 6 a. m., Sept 12, and continued uninterruptedly until the infantry assault at 6.20 a. m. on Sept 15. The new heavily armored cars, known as "Tanks," took part in this attack The advance met with immediate success on almost the whole front. The tanks entered Flers at 8.40 a. m., followed by large numbers of troops. The success on the right allowed the contemplated attack on the left, and Martinpuich and Courcelette were captured. The Quadrilateral (east of Ginchy) was captured Sept 18.

The result of the fighting of the 15th Sept was a gain greater than that of any single operation since the beginning. In one day's fighting the British broke thru two of the German main defensive systems and

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had advanced on a front of over six miles to an average depth of a mile. Three fortified villages had been captured, 4000 prisoners, including 127 officers, were captured.

Bad weather intervened, but early on Sept 24 a bombardment commenced, followed on Sept 25, at 12.35 p. m., by a general attack on the whole front from the Somme to Martinpuich. By nightfall Morval, Les Boeufs and a belt of country 1000 yards wide, north and west of Flers, had been captured. Gueudecourt was held by the Germans after very severe fighting, but was captured Sept 26. The French carried Rancourt and Frégicourt, and Combles was entered on Sept 26. The latter village was strongly fortified, and great quantities of stores and ammunition were found in the cellars.

The capture of a trench at Gueudecourt was accomplished in peculiar fashion. A tank started down the trench, using its machine guns and followed by bombers. Then an airplane flew along the trench and also used its machine gun, whereupon the defenders surrendered.

The time to take Thiepval had now come. Before the Germans could have time to recover, an attack was launched at 12.25 p. m., Sept 26, on Thiepval and Thiepval Ridge. The attack was a brilliant success. The tanks assisted. Three waves of attacking troops carried the outer defenses of Mouquet Farm, and pushed on and captured Zollern Redoubt. In two days of desperate fighting, Thiepval was captured. Prisoners taken brought the aggregate of captures, Sept 14-30, to nearly 10,000, with 27 guns, over 200 machine guns, and about 40 trench mortars.

Other operations resulted in the capture of part of Stuff Redoubt, all of Schwaben Redoubt, and ground in front of Le Sars and Eaucort L'Abbaye. The latter village was captured on Oct 3, after severe fighting. Other progress was made, so that, except at Sailly-Saillisel and north of Thiepval, the Germans had been driven from the whole of the ridge between the Tortille and the Ancre.

Around Thiepval, along the line from Gueudecourt to Le Sars, the situation could rest as it was for the time, but on the eastern flank it was important to gain ground. The Germans held a strong system of trenches covering Le Transloy, Beaulencourt, and Bapaume. Altho they were digging with feverish haste, they had as yet no very formidable defenses behind this line. A successful attack might lead to great results, and the resistance of the Germans had weakened.

At this juncture very unfavorable weather set in and continued practically unbroken thruout October and early November. Poor visibility hindered the work of the artillery, and the trenches became channels of deep mud. The roads became so bad as to be almost impassable, and supply became a serious problem. The difficulties were so great as to prevent the exploitation of the situation. The Germans had time to reorganize and rally their troops. Resistance became stubborn and counter-attacks frequent, and the moment for decisive action was passing rapidly away and the weather showed no signs of improvement. Nothing but a prolonged period of drying weather, not to be expected at that time of the year would permit further general operations.

Attention was now turned to the vicinity of Thiepval. Oct 21, in a short spell of fine weather, Stuff Redoubt and Regina Trench were attacked successfully. The artillery work was excellent, and over 1000 prisoners were taken with but slightly greater than that number of casualties. Oct 23, and again Nov 5, operations east of Les Boeufs and Gueudecourt were renewed in conjunction with French operations against Sailly-Saillisel and St. Pierre Vaast Wood, and considerable progress made. During these operations counter-attacks were frequent. One of these, on Oct 23, regained a portion of the ground captured east of Le Sars.

On Nov 9 dry and cold weather, with frosty nights and misty mornings, began, and preparations were made for an attack on the Ancre. The German works here were already strong and had been further strengthened in the light of experience gained on the rest of the front, and the gun defense was strengthened.

The preliminary bombardment on this front began at 5 a. m., Nov 11, and continued until the attack was launched at 5.45 a. m., Nov 13. The advance was made thru dense fog. South of the Ancre the objectives east of St. Pierre Divion were captured, and at 9 a. m. the number of prisoners exceeded that of the attacking force. St. Pierre Divion was captured a little later with 1400 prisoners, at an expense of less than 600 casualties.

North of the Ancre the resistance was more severe. Reaucourt was captured early on Nov 14. Progress continued eastward and northward up the slopes of Beaumont Hamel spur. Command of the Ancre valley, where it enters the German lines, was secured. The total of prisoners in these operations exceeded 7200, including 149 officers.

The operations on the remainder of the British front were secondary, but the duties were arduous, as it was their function to hold their own lines and keep the Germans in their front occupied; 360 raids were carried out, the largest of which, near Armentières, on July 19, penetrated deep into their lines and did much damage to their works.

The three objects of this offensive have been achieved. Verdun has been relieved; the main German forces have been held on the western front; and their strength has been very considerably worn down.

Information shows that the object of keeping the German forces tied to the western front was achieved. A movement eastward, caused by the Russian successes, stopped shortly after the opening of the Allied attack. The forces sent east thereafter were, with one exception, of divisions that had been exhausted in the Somme battle, and these were replaced by fresh divisions. The German strength on the western front in November was greater than in July.

There is sufficient evidence that the German losses on the Somme were greater than those of the Allies; hence the object of wearing down their forces was achieved. The German morale deteriorated during the

fighting. Many of their troops fought with the greatest determination, but the resistance in many cases in the later fighting was decidedly less than in the earlier actions. The depth of the defenses enabled the Germans to reorganize after each defeat.

"As our advance progressed, four-fifths of the total number of (German) divisions on the western front were thrown one after another into the Somme battle, some of them twice, and some of them three times; and towards the end of the operations, when the weather unfortunately broke, there can be no doubt that (their) power of resistance had been very seriously diminished."

The total of captures, July 1-Nov 18, is just over 38,000 prisoners, including over 800 officers, 29 heavy guns, 96 field guns and field howitzers, 136 trench mortars, and 514 machine guns.

These results were accomplished by an army the vast majority of whose numbers have been raised and trained during the war, and many of the drafts sent to replace wastage count their service by months and had their first experience of war in this battle. Such we had to use or fail our Allies. Their work constitutes a feat of which the history of the nation shows no equal. Men from every quarter of the empire and of its possessions have taken part in the Battle of the Somme. There has never been a higher test of the endurance and resolution of our infantry. Infantry would have been powerless without the effective support of the artillery, and in the combination of the infantry and artillery work the Royal Flying Corps played a highly important part, and their service was marked by great skill and daring.

Trench mortars, heavy and light, are an important adjunct to the artillery. Machine guns play an important, almost a decisive, part under some conditions. The highest value of these weapons is on the defensive, rather than on the offensive. The tanks proved of great value on various occasions.

(The services of the various auxiliary branches are acknowledged, but no detail is given as to the method of performance of their duties. The services of the commanders and staffs are eulogized.—Ed.)

"The German army is the mainstay of the Central Powers, and a full half of that army, despite all the advantages of the defensive, supported by the strongest fortifications, suffered defeat on the Somme this year."

[German Retirement on the Ancre. *Nation*, New York, Mar 1, '17. Quoted.]

Until more definite information is at hand regarding the extent of the German retirement on the Ancre, we must take the move to be part of the German plan in the west for feeding out small portions of ground to the enemy with a minimum loss of life. Such a saving is not the only compensation, however, for the ground yielded. There is undoubtedly the advantage of stiffened resistance in new positions which have not received the attention of the enemy's artillery. That, perhaps, is the main justification for the tactics of gradual withdrawal. If we imagine the British army preparing for the great spring "push," if we recall the infinite detail that goes into such preparation, the mapping of trenches and the adjustment of gun ranges to the last inch almost, we can see how the voluntary surrender of a mile or two of trenches by the Germans is likely to undo much of this preliminary work. Again and again in the Allied attacks in the west there has been a failure of great results because of a breakdown of the Allied plan along a small portion of the line. A sudden twist in the battle-line, such as the German withdrawal has produced, may necessitate weeks of new reconnaissance, range finding, road building, and a delay in the general offensive—all a sufficient price for a couple of square miles of abandoned terrain.

[From *The Spectator,* London, Mar 10, '17. Quoted.]

There can no longer be any doubt why the Germans have retreated on the Ancre. They have retreated because they were compelled to go. Of course, they put some disadvantages in our way, such as terrible shell-ploughed ground to cross, but to say that the opportunity of exposing us to disadvantages of that sort was their reason for retreating is a ludicrous argument. It is characteristic of minds which have become so mistrustful that they can find no explanation of our own rare yielding of ground except that we are beaten, and no explanation of a German retreat except that the stupid British are being led into a snare by the very deviltry of intellect. The account given by a special correspondent of the *Times* in Thursday's (Mar 8) paper of the appearance of the ground abandoned by the Germans proves that they could not possibly hold on any longer. Our officers knew that our guns had been doing much damage, but they had not conceived the extent of the ravages. Roads can no longer be recognized; communication trenches to the German front lines have been obliterated; the ground is covered with dead bodies of Germans drowned in bogs and craters where, pinned down by the shell fire, they could not move forwards or backwards.

—Engineering Operations

[New Zealand Engineers on the Somme *Army & Navy Gazette,* Feb 17, '17. 2800 words.]

The New Zealand engineers under the command of an Englishman have distinguished themselves in the Somme battles. Previous to the battles they dug much admired communication trenches. As the operations progressed, so did their work. They made deep dugouts for brigade headquarters and machine gun crews, they fixed up a dressing station and constructed aid posts where the doctors and their men could work with some degree of safety, they continued the communication trenches, dug assembly trenches, improved accommodations for battalion headquarters and various signal stations, and did much road work. Most of these operations entailed crossing a barrage of artillery fire twice a day and working under heavy shell fire which produced some casualties.

SOUTH AMERICAN WARS FOR INDEPENDENCE

[Causes of Victory and Defeat in the Campaigns of 1817-1818. By Capt. S. Polanco, M. General Staff. *Mem. del Ejército* (Chile), Sept, '16. 6000 words.]

(A historical study dealing with the military events connected with the battles of Chacabuco and Maipo, of the War of Independence.

The writer discusses the plan of campaign of General San Martin, and the manner in which it was executed. Success at the battle of Chacabuco was due to the errors committed by the Spanish General, Marco del Pont, and to the brilliant attack of the O'Higgins division. The tactical dispositions at the battle of Maipo, Apr 5, 1818, which followed Chacabuco, are next taken up.

The success of the campaign of 1818, is due to the tactical dispositions at the battle of Maipo, and not to the strategical plans of the campaign.

The work of the cavalry comes in for special commendation. At the time that the Ordóñez Division (Spanish) lauched a counter attack against the Alvarado Division (Chilean), the cavalry charged the enemy's lines, and stopped the advance, giving time for the reserve to be brought up. This movement turned the tide. What had been a critical state of affairs for the Chileans, became a complete victory.)

[The South American Wars of Independence. By G. E. Cronin, U. S. Army. Pamphlet. 10,000 words.]

(A chronological description of the effort for freedom in South America. It takes up in succession the parts played by Venezuela, Colombia, Ecuador, Peru, Bolivia, Brazil and Uruguay. The leaders, movements, and relations between the various republics in their incipiency, are disclosed in outline.)

SPAD AIRPLANE

[The Spad Scout, Type S VII. *Aerial Age Weekly*, July 9, '17. 512 words. Illustrated.]

Improvement is so rapid and changes are so frequent in the design of the Spads, developed by the "Société Anonyme pour l'Aviation et ses Dérives," Paris, that the type used within the next six months may differ in several respects from that in use to-day. The approximate general dimensions of the S VII are as follows:

Span, upper plane (7.800 meters)	25 ft. 6 in.
Chord, both planes (1.400 meters)	4 ft. 7 in.
Overall length (6.100 meters)	20 ft. 0 in.
Total weight	1525 lbs.
Useful load	470 lbs.
Climb in ten minutes	9300 ft.
Speed at sea level	132 mi. per hr.
Speed at 3000 meters	126 mi. per hr.
Motor, Hispano-Suiza V Type	160 h.p.

Both planes are nearly rectangular in plan, the ends being square and not raked, the corners being slightly rounded off. As the ailerons are comparatively narrow, they must be carried on a subsidiary wing spar located about nine inches back of the main beam. The fuselage is exceptionally deep and the bottom curved below the lower longerons as well as the sides and top, giving a smooth stream line effect. The fore end of the machine which houses the motor, is covered with aluminum, with a circular radiator opening which resembles the cowling of a rotary motor. The usual fixed stabilizing plane and elevators are employed. Wheels of the landing gear have a track of 5 feet; the axle runs in slots which guide it up and backward in line with the rear chassis struts. Shock absorption is with rubber cord. The Hispano-Suiza motor develops 160 h.p. at 1500 r.p.m. The weight including carburetor, magnetos, starting crank, and propeller hub, but without radiator, water, oil and exhaust pipes is 445 lbs. Fuel consumption, one-half pound of gas per horsepower hour; oil consumption, three quarts per hour.

SPAIN

See also
COAST DEFENSE—SPAIN

—Army

See also
CLUBS, MILITARY—SPAIN
MOROCCO

—Army—Artillery

See also
FIELD ARTILLERY—INSTRUCTION AND TRAINING—SPAIN

[Increase in the Spanish Artillery. *Schweiz. Zeit. f. Art. u. Genie*, May, '16. 600 words.]

Field Artillery

Each Infantry Division: 1 regiment of three battalions, each battalion three batteries.

Each Cavalry Division: 1 horse regiment of two battalions, each battalion three batteries.

In addition, light howitzers, 14 battalions, of three batteries each.

Mountain Artillery

Three regiments of two battalions, each battalion of three batteries.

Heavy Artillery

1 Regiment of three battalions. 1 battalion to consist of three batteries of 12 cm. guns; 2 batteries each of three batteries of 15 cm. howitzers (old type).

Siege Artillery

Four battalions, each of four batteries armed with the 15 cm. gun (old style), and the 21 cm. howitzers or mortars.

Fortress and Coast Artillery

Cartagena, Cadiz, Ferrol, Mallorca, Minorca, Tenerife, Canary Islands, Barcelona, Badajoz, San Sebastian, Pamplona.

Arsenals and Ordnance Works

1. Toledo; 2. Granada (powder and explosives); 3. Oviedo, small arms); 4. Sevilla (guns); 5. Trubia; 6. Sevilla (ammunition). The following new matériel is to be purchased: 33 batteries of 15 cm. howitzers; 6 batteries of 12 cm. guns; automobile trucks and tractors for these units; airplanes.

—Army—Cavalry

See
CAVALRY—ORGANIZATION—SPAIN
HORSES—BREEDING OF—SPAIN

—Army—Organization

[Proposed Military Organization. Supplement to *Memorial de Caballeria,* Aug, '16. 3000 words.]

According to the proposed organization, the army of the Peninsula will be composed of 115,731 men and 34,486 horses and mules. The African army will have 68,399 men and 16,091 horses and mules. A total increase of 43,652 men and 12,191 animals is called for.

The first line army is to consist of 180,000 men which may be increased almost immediately upon mobilization to 400,000 men.

Cadres are organized for a second line or reserve army of 600,000 men.

The organization is by divisions. The first line army is formed of 18 divisions, 10 active and 8 in cadres. The division normally will be composed of 4 regiments of infantry; a "group" of two squadrons of cavalry, a regiment of field artillery, a "group" (battalion) of heavy field artillery; with engineers, signal, supply and sanitary units. The peace strength of the infantry companies in the active divisions is 100 men; of the squadrons, 120 men.

There are two independent cavalry divisions. Each division has three brigades of two regiments each with a cyclist battalion, a "group" of horse artillery and a detachment of engineers, with also the corresponding sanitary and supply services.

Details are worked out for a rapid mobilization of the necessary elements in men, material and animals. Industrial mobilization is provided for and a voluntary Automobile Corps is created.

[Some Considerations on Organization and Military Instruction. By Arturo Bariones, Major of Infantry. *Mem. de Infantería,* Nov 8, '16. 1000 words.]

One of the defects of our present system is the great number of officers separated from the ranks. We have at the present time in the Second Reserve 116 separate battalions. All agree that the regiment is the best school for officers. In the same manner that the First Reserve now constitute the third battalions, the Second Reserve should form the fourth battalions of the regular regiments.

This change would permit a greater number of officers to practice their duties in the regiment, would reduce the quota of officers for a regiment by employing the majors now serving as inspector-instructors of the regiment as commandant of the fourth battalions, and would facilitate the incorporation of the reserves.

The principle of the nation in arms is now a reality, and all able-bodied citizens, including those now excepted for family reasons, must in future be trained for military duties.

A new organization of the depot battalions could be arranged to provide for the training of citizens with but little additional cost over the present system.

If the depot battalions were organized as are now those of the Second Reserve, but their own officers residing within the limits of their company districts, the training could be had in three or four short periods during the year to the great convenience of the recruits who could avail themselves of the period least unfavorable to their work.

No uniforms would be needed for this training, except perhaps hempen shoes, which could be obtained at little cost. Fifteen or twenty rifles to each company would be sufficient for target practice, and unserviceable or even wooden guns, such as are used in military schools, would serve for drill purposes.

Comparative Expense

Based on an estimate of 13,461 recruits trained during the past year at a cost of 30 pesetas each for clothing and uniform, we have under the present system a total expense of 403,830 pesetas.

If in place of the 116 battalions we create 125 battalions, to be trained as above outlined, the total cost (pay of additional officers required) would be 483,780 pesetas; an excess of 79,951 pesetas, which would be more than compensated for by doing away with officials of the military schools who would no longer be needed.

—Colonies

[Strategic and Commercial Itineraries in the Zone of the Protectorate. By A. de S. *Memorial de Caballería,* Dec, '16. 1500 words. 2 maps.]

(Continuation)

(The great characteristics of the Zone, Melilla, its communications and surroundings, and the active organization of the territory, are described. Reference to the maps is necessary in order clearly to understand the article.)

[Strategic and Commercial Itineraries in the Zone of the Protectorate. By A. de S. *Memorial de Caballería,* Jan, '17. 1100 words.]

(Continuation of a description from a military point of view of the physical features, topography, geology, etc., of Northern Morocco. Readers are referred to the Spanish Military Map, Scale 1:60000.)

—History

[Activity of the Spaniards in Morocco. Operations Against El Buit and Ain Yir (26-6-916). By José A. de Soto, Major of Cavalry. *Mem. de Infantería* (Spain), Oct, '16. 1300 words and sketch. To be continued.]

These operations were undertaken to punish the villages of Ain Yir and El Buit, and to occupy important strategic positions in the heart of the Gaba, focus of rebellion in Anghera.

The attacking troops advanced in three columns within supporting distance with a fourth column, in reserve, following the center column.

The enemy occupied a strongly intrenched position on the crests of the Ain Yir, covering all approaches to the hostile villages. The terrain was steep, rocky, broken with ravines and covered with woods and underbrush.

The left column, moving under the darkness, completely surprised the enemy near Hafa del Hamara, and pushing on by Seriya toward Ain Yir, turned the right flank of the hostile position.

SPAIN—Continued

The right column from Federico, advancing thru the woods and ravines, gained a position on the hill before El Buit, threatening the line of retreat from the intrenched position.

The center column, followed by the reserve, attacked the position in front.

Under pressure of these combined attacks, the natives soon gave way, leaving many dead and wounded on the field. The victory was followed by complete submission of the hostiles on the next day.

Operations conducted by General Barrera and the Shereef El Raisuli on this same day against other portions of this tribe were equally successful and were the fruits of the conscientious study and preparation by the commander-in-chief and staff officers and the officers connected with the service of information and native affairs.

—Military Policy of

[Military Art. Bases and General Outlines of a Projected Military Organization for Spain. By General Ricardo Burgete. *Mem. de Infantería*, Oct, '16. 4000 words. (To be continued.)]

To be efficient, the military organization of a state should conform—

1. To the nature of war.
2. To the population and area of the state.
3. The topography of the country.
4. The economic resources of the state.

Nature of War.—The great fronts heretofore assigned to the domain of strategy have now been extended to include the fields of tactics and organization, and we have passed from formations in depth to thin extended lines.

As it is not possible to be equally strong at all points of greatly extended fronts, armies are now divided into two great bodies; a mobile force made up of the youngest and strongest troops having greatest offensive power, and a larger body made up of reserves and second line troops whose mission will be passive and defensive. This division of forces admirably suits the topography and history of Spain, and was in use in the epoch of its military greatness.

Population and Area.—If we consider the forces mobilized in the present war, we note that they number about 9 to 11 for each square kilometer of territory, or from 10 to 15 per cent. of the poulation. On this basis Spain should have two million soldiers, and with simple changes in the present laws and without increased expenditures, Spain can maintain one-half million troops armed and equipped, one-half million in reserve, and one million trained territorials.

Territory.—The mountain systems of Spain are true frontiers and divide the territory into departments that mark distinctly the possible theatres of war. The present distribution of troops is impracticable and absurd, regiments being scattered over fronts of from 100 to 150 kms. and parts of divisions being separated in some cases by impassable mountain barriers. To concentrate these commands in time of war would necessitate long marches and the abandonment of many of the stations they now occupy. If they were continued in the positions now occupied, they must of necessity be reinforced by other troops, with such a confusion of command and lack of unity of action that only disaster could result.

Economic Resources.—Of the annual appropriations for public purposes, Spain apportions about 19 per cent. for military purposes. While this is somewhat less than the average for the other European nations, yet, having in mind the greater economy forced upon Spain, the results attained in a military sense should be comparable to that of the other powers.

Spain can actually mobilize at the present time only about 17 divisions. On the basis of results attained by the other powers, Spain should, without increased expenditures be able to maintain 500,000 active troops, 500,000 in reserve, and 1,000,000 territorials.

—Military Topography of

See also

SPAIN—MILITARY POLICY OF

[Geographic Study of the Mountains of Toledo. By Verado Garcia Rey, Captain of Infantry. *Mem. de Infantería*, Oct, '16. 5000 words. Two photographs and outline sketches. (To be continued).]

First Group

The alignment of the range made up of Yebenes, Castanar and Vedado is generally east and west. These mountains are rugged and barren, and their slopes and ravines covered with loose stone; the rock is quartz and slate, and the range is characterized by many sharp peaks locally termed "Riscos." The summits vary in height from 1100 to 1300 meters. To the south of this range lies the mountainous labyrinth of the Guadalerzas, a complex network of spurs and ridges, with elevations of 900 to 1300 meters. The main line of this range is parallel to the Yebenes-Castanar range, and rises from an altitude of 750 meters at the Congosto pass to 1370 m. in the Bacerra Peak, falling away to the plains near the headwaters of the Milagro.

The slopes and ravines of all these mountains are covered with heaps of loose stones which are typical of the Toledo mountains and are due to the breaking down of the exposed quartz ledges.

Inclosing the Guadalerzas and connected with them are two other mountain lines—the Sierra Calderina and the Sierra Malagon. On the east and west slopes of the Calderina are the Emperor and Matanza passes.

Lying within the limits of this group are the plains or open fields of Algodor and Milagro at an elevation of 750 m. The plain of Urda, with an amplitude of 14 k.m. from north to south, and 12 to 18 from east to west, and the valley of Ballesteros, generally covered with small clumps of woods and undergrowth except at the lower end, where are some cultivated lands.

The water courses thru these valleys are dry during the greater part of the year.

Second Group

Prolonging the line of the Yebenes-Castanar range are the mountains of San Pablo, Navahermosa, and Los Robledos. As far as San Vicente this range is

well defined as a single line. At San Vicente an important spur branches off toward the northeast, separating the waters of the Bullaque and Estena. Beyond San Vicente the range tends northwest and becomes greatly complicated with many spurs and narrow, deep ravines. This section is very barren and rugged, and the trails are mere footpaths connecting the few scattered hamlets.

Hydrography

Owing to the nature of the soil and the limited rainfall thruout this section of the country, there are but few springs in the mountains, and the water courses are generally dry during the summer.

The Toledo mountains, in their eastern part, furnish little water to the Tajo and Guadiana rivers. From the Milagro pass to the line Estena-Navahermosa, the supply increases and becomes fairly abundant further to the west. Thruout the central and western parts are found true valleys with considerable vegetation, but in the eastern part the water courses are barrancas and deep ravines.

An interesting feature of this section is the seeming break in the continuity of the divide separating the waters flowing to the Tajo and Guadiana. In the open plains lying between the Guadalerzas and the Yebenes-Castanar range, the sources of the Milagro and Algodor appear to be the same, tho one is tributary to the Guadiana and the other to the Tajo, and in flowing out of the Navajo swamp in which they rise the waters direct themselves indifferently to the one system or the other.

Principal Passes

1. The Milagro, thru which runs the road from Toledo via Argés to Ciudad Real.
2. The Marché Pass, thru which runs the road called Real de Estremadura.
3. The Valeruela or Pass of the Cedrón, thru which goes the road from Toledo-Navahermosa to Navas de Estena.

Except for the compact rampart formed by the Sierra Yebenes-Castanar up to the Pass Milagro, the rest of the mountain system of Toledo is a labyrinth, and the trails and paths leading from one slope to the other are high and inaccessible.

As a means of comparing the difficulties presented by a mountain range to military operations, the following measurements are suggested.

1. The average altitude of the ridge line.
2. The average altitude of the pass.
3. The average altitude of the summits.
4. The average cut of the ridge line.

For the Toledo Range these figures are as follows: 1st 1160 m.; 2d, 920 m.; 3d, 1040 m.; 4th, 244 m.

SPIES AND SPYING

See

ESPIONAGE

STAFF

See also

SANITARY SERVICE—MILITARY FUNCTIONS OF THE

—General Staff

[Formation of the General Staff. By Miguel Primo de Rivera, General of Division. *Mem. de Infantería,* Nov, '16. 2000 words.]

The success of any undertaking, whether it be commercial, artistic, or mercantile, depends upon the ability of those charged with directing its affairs. This is equally true of an army, and any plan of reorganization, to be satisfactory, must recognize this fact and provide for a careful and critical selection of the officers destined for high command.

To insure a homogeneous structure, all officers should start in as lieutenants after receiving preparatory training in a common center. Promotion to the grade of captain should be by seniority only, as at this stage the qualities to be tested are physical aptitude, endurance, perseverance in the vocation, and obedience.

Promotion to the grade of major and lieutenant-colonel might open the door to limited selection, but the shameful struggle to secure desirable stations or duties justifies the fear, now general thruout the army, that improper influences would be used to secure the greater advantages of promotion.

The rank of lieutenant-colonel should be the highest to which an officer is entitled by regular promotion. Upon reaching this grade, he should be required to state whether he aspires to higher command or wishes to terminate his service; if the latter, he should be assigned to the reserves or given a station and duties suited to his rank and abilities. If he elects to continue his career, he should be subjected to a rigorous examination testing his mental and physical qualities and his aptitude for high command. The mental test should demonstrate a solid instruction in history and geography and an up-to-date knowledge of methods of modern warfare, including changes in matériel and organization. Having satisfied these tests, he should be assigned to the command of a body of troops of his own arm for a period of three years. If during this period he shows discretion, tact, certainty and promptness of decision, he should be advanced to the grade of colonel and given a mixed command involving administrative duties and tactical leadership of a high order as a further proof of his fitness for the General Staff.

STAFF COLLEGES

—Portugal

[The Military College. By Carlos Elias de Costa, Junior, Capt. of Art., and Professor at the Military College. *Revista da Artilharia,* Aug, '16. 3000 words.]

(Continuation of the article in the June number.)

[The Military College. By Carlos Elias de Costa, Junior, Capt. of Art., and Professor at the Military College. *Revista da Artilharia,* Sept-Oct, '16. 9000 words. To be continued.]

(A continuation of the history of the Military College of Portugal.)

[The Military College. By Carlos Elia da Costa, Jr., Capt. of Artillery, and Professor at the Military College. *Revista da Artilharia,* Nov, '16. 5500 words. (To be continued.)]

STAFF COLLEGE—Continued

A continuation of the history of the Military College in Portugal.

[The Military College. By Carlos Elia da Costa, Jr., Capt. of Artillery and Prof. at the Military College of Portugal. *Revista de Artilharia,* Dec-Jan, '16-'17. 5000 words. Concluded.]

STANDARDS

See

FLAGS

STEEL

—Use of in Aeronautics

[Steel for Aeronautical Purposes. By G. A. Richardson of the Midvale Steel Co. *Aero World,* Jan, '17. 5800 words.]

The classes of steel available for aeronautical purposes may be divided as follows:

1. That for structural parts; as wires, struts and body parts.
2. For power plants and transmission parts.
3. For protective armor.
4. For aeronautical instruments.

In considering the kind of steel to be used the following points must be considered: the stress or strain on the member, whether minimum weight with maximum strength is the only consideration, the resistance to corrosion and the extra cost. Owing to the lack of uniformity in airplane manufacture the fund of data is extremely meager.

From experiments and experience the best wire for airplane use is found to be that which is sufficiently strong and serviceable to permit of some reduction in weight, but which combines with a high tensile strength toughness and ductility as well. Such wire is made of high grade carbon steel. Vanadium steels and other steels of their kinds have not as yet become desirable wire steels. The disadvantage of being subject to corrosion is overcome by galvanizing and painting. Struts must embody great strength with as little weight as possible and offer a minimum resistance to the wind. Cold drawn chrome nickel steel of special cross section answers all the requirements for steel for struts.

The steel for motor parts must not corrode easily, must not change excessively with changes of temperature, but it must be capable of being worked up easily. Undoubtedly one of the causes for aeronautical motors not standing up as well as automobile motors is that manufacturers in their desire to reduce weights have cut down the section of operating parts to a point where efficient working is interfered with. A 25 per cent. nickel steel is best suited for cylinders, as it is extremely tough, possesses sufficient strength and does not wear at all but glazes. It has the disadvantage of being hard to machine. Pistons and connecting rods can be made of chrome-nickel steel of hollow section. Crank shafts can be made of nickel steel but must be kept within certain sizes to avoid whipping. Valves are now being made of carbon steel by the automobile manufacturers. Altho it is impossible to put armor on military airplanes to stop shell fire it is necessary to use some protective armor. A plate two-tenths of an inch thick made of nickel, chrome, molybdenum composition will withstand a U. S. standard service Springfield cartridge at a range of 60 or 70 feet. This alloy is easily manufactured and can be made in any shape desired. It is thus very easy to protect the occupants of a machine against rifle and revolver fire and by increasing the weight of the plate a little it will withstand shrapnel and bursting shell.

Steel used in aeronautical instruments must be free from the following disturbing effects; vibration, change of altitude and change of temperature. A nickel steel alloy has none of these defects. By increasing or decreasing the nickel almost any coefficient of expansion can be obtained and also a steel that is non-magnetic and not affected by corrosive action.

—Use of in the Manufacture of Armament

[Big Gun Steels. *Scientific American,* Aug 4, '17. 100 words.]

It is reported that Germany is lining her big guns with a uranium steel which stands up at a rate of fire destructive to all other known steel alloys. The ferro-uranium required is ordinarily obtained as a by-product of the manufacture of radium. The matter is being looked into by the Bureau of Mines in connection with Cornell and other universities.

STELLITE

[Stellite vs. High-speed Steel. By R. Sylvany and H. Haeffely. *Journal Franklin Institute,* Mar, '17, from *La Chronique Industrielle,* vol. 39, No. 279, p. 6, Dec 28, 1916.]

According to an account given in *Métaux et Alliages,* the hard non-ferrous alloy, stellite, invented three or four years ago in the United States by Elwood Haynes, marks a still greater advance in the art of cutting metals than established by the notable results obtained with the introduction of high-speed steel some years earlier. Where rate of production is a critical matter, as in the manufacture of ammunition, it has already made a remarkable record in competition with high-speed steel, a material which in point of capacity of production outclassed steels previously used. One of the advantages of stellite is that its hardness, which it maintains even at a red heat, is solely dependent upon the composition of the alloy, tungsten and chromium with additions of cobalt and molybdenum, and not upon the difficult and uncertain operations of heat treatment. Its fundamental advantage, however, lies in its ability to withstand a marked increase in speeds and feeds over those previously used with high-speed steels.

Among the already numerous machine shops employing stellite, the Fonderie des Gobelins in Paris reports that a daily production with high-speed steel of 120 shells of 155 mm. was increased to 200 by the use of stellite. With high-speed steel 21 minutes were consumed in roughing out at a speed of 17 meters and a feed of 0.7 mm. For finishing, the same speed and feed were employed and the same time it was consumed. With stellite the roughing-out occupied 11 minutes at

a speed of 25 meters and a feed of 0.85 mm. For finishing a speed of 37 meters was maintained with a feed of 1.67 mm. consuming 4 minutes. For completely finishing 1000 shells of 155 mm., the cost of stellite is about 0.30 francs per shell. Other firms report equally favorable results in this class of work.

STERILIZATION
—Of Water Supply
See
WATER SUPPLY—STERILIZATION

STRATEGY
See also
EUROPEAN WAR—MILITARY SITUATION
NAVY—STRATEGY
RAILROADS—STRATEGIC
TACTICS

[The Fundamental Strategical Principles of War. By Maj.-Gen. Sir C. V. F. Townshend, K.C.B., D.S.O. *Jour. United Service Institution of India,* Apr, '17. 3000 words.]

(*Editorial Note.* This article was written prior to the outbreak of the present war.)

[The fundamental principles of strategy are discussed under the headings:

A. The principal objective should be the bulk of the enemy's forces in the field.

B. The Principle of Economy of Force.

C. Principle of the Mass.

D. Principle of the Strategic Offensive.

E. The Principle of Economy of Direction or the Principle of Rapidity.

F. The Principle of Security.

Having been written before the outbreak of the European war, the illustrations of strategical principles are from the Napoleonic and subsequent wars, and particularly from the Russo-Japanese war.

An article of the same general nature but with illustrations from the European war, will be found on pp. 273-6, INTERNATIONAL MILITARY DIGEST ANNUAL, 1916.—ED.]

STREAM CROSSING
See
RIVER CROSSINGS

SUBMARINES
See also
COAST DEFENSE—USE OF AIRCRAFT IN (Article: "Effect of Appearance of the Submarine and Aircraft on Coast Defense")

[Torpedoes and Submarines. By Charles Nordmann. *Revue des Deux Mondes,* Nov 1, '16. 4600 words.]

The torpedo is to the submarine what the shell is to the gun. The torpedo itself is but a submarine in minature.

A submersible is a vessel capable of navigating under water, when it is so desired. The floatability of a vessel is that part of its tonnage unsubmerged when the vessel floats upon the surface of the water. In the earlier submarines, the floatability was small; only about 5 per cent. at the beginning. They needed to take in but a small quantity of water in order to submerge. They rode low in the water, which offered, therefore, great resistance to their movement. They had little speed. They had difficulties in a rough sea, whose waves swept over them; they were unpleasant to live in.

A French naval engineer conceived the idea of constructing them with a larger floatability. The vessels so constructed were given the name of *submersibles.* Laubeuf's *Narval* had a floatability of 42 per cent. Since then, submersibles have been given a floatability of from 20 to 40 per cent. The latest German type seems to have about 20 per cent. The Germans designate them by a number following the letter U, an abbreviation of *Unterseeschiff.*

The pseudo-commercial submersible *Deutschland* has about that floatability, with a tonnage of 1600 or 1700 (when immerged). All these German vessels are modifications of the French engineer's conception.

Since the *submersibles* have to take in a considerable quantity of water to dive, their reservoirs have been placed outside and all around the hull; they are, therefore, constructed with a double shell, with two envelopes something like a thermos bottle. The exterior shell is thin and weaker because, with the water on both sides, it does not have to resist the pressure; the interior shell which must resist the hydrostatic pressure is of thick sheet-iron.

The increase in the mass of water to be taken in has not interfered with the rapidity of immersion in case of need; the vessels can immerge in five minutes.

Monsieur Maurice has proposed the name *immersible* as a term to include both submarines and submersibles. The general adoption of this term would prevent confusion. The name *submarine* would then mean an immersible of weak floatability while the name *submersible* should be reserved for immersibles having a greater floatability.

The submersible is superior to the submarine in tonnage, nautical qualities, radius of action, and offensive capacity. On the other hand, it draws more water, is more vulnerable to guns or torpedoes, and cannot immerge in shallow water. When it is inclined under water, its length is a menace; thus a vessel 100 yards long inclined at 10 degrees, will have one end 17 yards lower than the other—a source of danger from accidents, and a condition requiring increased depth of water. The cost of construction is greater.

Because of these conditions certain navies, like those of England, the United States and Japan, will use both types; the submersible as an attacking engine with a large radius of action, the submarine as a defensive engine for coasts and harbors, with a smaller radius of action, but more manageable. The Germans in their submarine warfare use the submersible type exclusively.

In the mechanisms used to operate the immersibles are combined the subtlest improvements in technique and science.

The propeller must not use up the precious supply of respirable air, must not produce too much vibration or shock, must not produce any considerable quantity

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of products that have to be evacuated. Only electric storage batteries come very near to satisfying these conditions. These, however, have several defects, a great one being their weight.

To get a sufficient radius of action for immersible craft, storage batteries have been given up for navigation on the surface. Steam motors, or oil motors of an internal combustion type, are used when the vessel is not submerged, the surface motors serving also to recharge the storage batteries, which are used under sea. This makes it necessary for the vessel not to remain too long submerged. It must rise for fresh air and for new energy for its storage batteries.

No satisfactory single motor for both surface and undersea navigation has been devised. However, before the war M. Maurice, director of the Naval Engineers' School, had been studying a special steam engine in which steam was produced, not by the oxidation of a combustible, but by heat accumulated on the surface, thanks to a special thermal storage apparatus concerning which we are not permitted to give any details. It is probable, as Admiral Degouy has remarked, that the Germans with their usual habits of plagiarism have applied this idea in their recent submersibles, for Krupp is now constructing a boiler exactly resembling that devised by M. Maurice.

Just as the airplane is heavier than air and remains in equilibrium therein only by its speed, so the submarine or the submersible, by reason of being lighter than water, is, during movement, held under water by its speed alone, which prevents it from rising to the surface. This result is obtained by means of small wings or fins (so to speak) placed on the hull at the proper angle of slope, which is upward to the rear; whereas in the airplane the slope is upward toward the front. If the vessel stops moving, it automatically rises to the surface. The security thus obtained is increased by means of powerful pumps, which in case of need permit rapid emptying of the water reservoirs. Under the hull, moreover, are fixed safety plugs easily opened in case of need.

Submersibles have practically no submarine vision; aerial vision is provided by the periscope, rising slightly above the surface.

The torpedo has remained the principal weapon of the submarine. Its effects are more terrible than those of any other weapon so far devised. Its effects are more intense under water than in the air.

Most navies use wet gun-cotton as an explosive. The Germans seem to prefer trotyl or trinol, derived from the nitrification of toluol.

The best depth for the course of the torpedo is from three to four meters. To keep it at this depth, a manometer is now provided; subjected to the pressure of the column of water below, this manometer acts automatically by means of springs on a horizontal depth-rudder quite similar to that of an airplane. To keep it straight on its course there are vertical rudders controlled by a gyroscope. The speed of the torpedo is about 80 kilometers per hour. A vessel can best avoid a torpedo by zigzag, or irregular movement.

The torpedo has become much more efficacious since the development of the submarine than it was before. The torpedo boats for which it was originally designed have difficulty in getting close enough to use it upon battleships.

[The Decay of Sea Power. By Arthur Pollen. *Land and Water*, Dec 21, '16. 2700 words.]

The explanation of Germany's peace offer lies less in the conquest of Rumania than in the belief that the submarines have conquered the sea.

According to German statements, the rate of destruction since last August approximates 3,000,000 tons a year. Great Britain's normal capacity for ship building may be put at 2,000,000. Clearly the length of time during which the Allies can continue to fight must depend first on how long it will take the submarine to bring the existing shipping to an irreducible minimum, and, secondly, on the capacity of the shipbuilding of the Allies to keep pace with subsequent destruction. In this statement, inability to stop the depredations of the submarines is assumed. Arming merchantmen and building new merchantmen are measures suggested to compensate the results of the submarine campaign. If all merchantmen, neutral as well as belligerent, were ultimately armed, so that the rate of destruction would not exceed the rate of production, the Allies could finish the war without economic distress or slackening of military efforts. But the world would be face to face with an extraordinarily unsatisfactory condition. It would mean that the submarine had made the policing of the seas—which for 100 years was the sole function of the British Navy—entirely impossible. The world, so far as it relied upon seaborne supplies, would be at the mercy of the first anarchical power that chose to proclaim a submarine attack on trade.

If the war continues for another two years, self-defense of ships cannot be relied upon satisfactorily to diminish losses at the present rate, nor can replacement compensate for them. The only solution which will make the present situation safe and the ultimate state of things tolerable, is that which will result in the majority of the submarines being destroyed either before they can win the open sea, or on their return to port. Submarines of the *U-53* type have a radius of action of over 10,000 miles, a surface speed of 18 knots, and a submerged speed of over 10 knots. Their battery power enables them to travel 70 miles under water. They carry 10 or 12 torpedoes, and are armed with 4.2 or 5.5 guns. They are over 200 feet in length. They can spend 12 days going and coming, and 60 days cruising on trade routes.

The disadvantages of submarines are blindness, low speed and vulnerability on the surface.

An application of the principles of under-water hearing for use in detecting the presence of submarines is one of the methods proposed for protection against these vessels.

It is reassuring that the following statements may be accepted as correct:

(1) There is no invention that can help a submarine in the evasion of surface craft that cannot equally help the surface ship in pursuit and attack.

(2) To rob the submarine of the capacity of secret approach—and therefore of secret passage—is to rob it of the only quality that enables it to find the open sea to-day.

(3) There is no form of scientific invention, used by the Germans, that has not been either anticipated by British inventors, or cannot be surpassed by the British inventor when occasion requires.

[Sighting Submarines. *Army & Navy Gazette,* Mar 10, '17. 275 words.]

A prize of 20 pounds in value is to be given to "anyone on board a British commercial vessel who first draws the captain's attention to an enemy submarine in the vicinity." An alert lookout at all times, especially at dawn, is of the greatest importance.

[Submarine Crews' Rewards. The N. Y. *Evening Post,* Apr 9, '17. Quoted.]

The frontier correspondent of the *Telegraaf* suggests that the recklessness shown by German submarines is due to the big financial rewards offered to the crews by the German Government. The men who man the submarines get 10 per cent. higher pay than those in any other branch of the national service, and receive, in addition, substantial bonuses.

Fifty per cent. of the value of a captured ship is distributed among her captors, 5 per cent. to the commander of the submarine, 5 per cent. to the chief engineer, 15 per cent. to the remaining officers, and 25 per cent. to the crew. Percentages for torpedoed ships are based on the insurance value of the vessel. In these cases the submarine commander gets 1 per cent., the chief engineer 1 per cent., the remaining officers 4 per cent., and the crew 10 per cent. There are also extra rewards for special exploits.

[Submarines in Periodical Literature from 1911 to 1917. Compiled by Helen R. Hosmer. *Jour. Franklin Institute,* Aug, '17. 20,000 words.]

(This compilation gives an abstract of 91 articles that have appeared in the principal technical, scientific and naval periodicals during the period 1911-1917 concerning the design and use of the submarine. Very brief reviews are also given of four books, suitable for the purposes of the general reader, dealing with submarines.

The outline is classified under the headings: (1) General, (2) Propulsion, (3) Armament, (4) Special Equipment, (5) Builders, (6) References.

The references give the date and publication in which the articles cited appeared. The summaries are sufficient to give an excellent idea of the development and present status of the submarine, and the references furnish the means for further investigation to anyone desiring to pursue the subject. Being in itself a summary of great length, no useful condensation can be given here.)

Germany

[The Torpedo and Submarine Branches of the German Navy. By Commander Reginald R. Belknap, U. S. Navy. *Proc. Naval Institute,* Sept-Oct, '16. 8000 words. Tables.]

(The enlisted personnel of the German Torpedo Service are the pick of the men assigned to the Navy. How this personnel is organized, so as to avoid red tape methods, the schedule of training and the methods of inspection are subjects covered in this paper.)

[Submarines: Neutrals and Peace. By Arthur Pollen. *Land and Water,* Oct 5, '16. 3700 words.]

(After a review of the submarine question the author undertakes to dispose of some of the prevailing misconceptions as to the effectiveness of submarine warfare.)

Ratio of Submarine Success

(1.) If a given number of submarines appear in the waters around Great Britain, experience shows that a certain toll may be taken of the shipping entering and leaving her ports. For purposes of argument, this toll may be put at one ship per day. (2.) If the number of submarines be doubled or trebled, the toll will rise, but not in the same ratio. Thus a threefold increase of submarines will, let us say, yield a toll of two ships per day. (3.) If ships are sunk on sight, the chances of submarine success will increase roughly about 50 per cent. Thus three times the normal number of submarines, acting on the abnormal principle of sinking on sight, may be expected to raise the loss from two a day to three. It should be pointed out here that this expectation of success must be limited in point of time. (4.) The reason why an increase in the number of submarines cannot give a corresponding increase in the number of victims, nor to continue to take an increased toll for more than a short period, is that an extensive and vigorous force is engaged in protecting shipping and in attacking submarines. If underwater boats are increased in numbers, the numbers that fall victim to our campaign are increased in a still higher ratio. This condition is conceivably borne out by the facts. Hence entirely apart from the unpleasant consequencs that would fall to Germany from America if a ruthless submarine warfare were kept up, it must be recognized that the British have very little to fear, and the Germans very little to hope, from any increased effort in the submarine direction, because experience has shown, that the greater the effort made, the more rapidly is it brought to an end.

Ton for Ton

An astonishing feature of this submarine warfare is that neutrals do not seem to see in the position created by Germany, something far more menacing to them than to us. For every British or Allied ship sunk by the Germans, there will be a German ship the fewer sailing under German colors when peace is restored. There is no manner of doubt that no German merchant ship will put to sea at all until ton for ton compensation has been given. Hence in the new state of things

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after the war, French, Russian, Italian, and above all, British shipping will start upon their world trade at least as strong in tonnage as they respectively were on the first of August two years ago. German merchant shipping will be proportionately reduced, and it is for the Germans to say how much smaller they wish it to be when the war is over.

Some idea of the position of neutrals in the new competition after the war may be formed from the case of Norway. A fortnight ago it was officially announced that 101 Norwegian steamers and 47 sailing vessels had been sunk since the war began; 13 of her steamers have been sunk since. The total loss is now $22,500,000, and this loss is by insurance spread over the whole community. It is conceivable, but hardly likely, that some portion of this loss will be later paid by Germany in the form of cash, but if it were all repaid, it would not replace the Norwegian keels that are gone. No other nation has lost so heavily as Norway, but Sweden, Denmark and Holland have, in the aggregate, a heavy score to charge against the common enemy. We know that Germany longs for peace and that neutrals are as anxious for it as the Germans. Would it not be wise for neutrals to put pressure upon Germany in order to quicken her realization of things as they are?

[German Submarines of Three Types. *New York Times*, Feb 4, '17. 2200 words. Illustrated.]

Several American and British naval officers questioned agreed that by a conservative estimate Germany has 150 to 200 submarines of all types, exclusive of mine-laying submersibles, and that the number certainly does not exceed 300. They all agreed that within the past few months possibly 60 mine-laying type submersibles, called "U C" to distinguish them from "U" boats, had been completed.

The *U-53*, recently at Newport, represents the latest type of U-boat. The numerals of these boats run from about 50 to 150. They have a surface displacement of 650 to 850 tons, a submerged displacement of 800 to 1000 tons, engines of 900 to 2400 h.p., an average surface speed of 12 knots, and a cruising radius of 2000 to 4000 miles.

Some of these boats can remain stationary, submerged, for several days or travel more than 100 miles submerged, at a speed of 10 to 12 knots. Some of them (the *U-61* to *U-65*, inclusive) have a surface speed of 18 knots and a submerged speed of 10 knots or more.

There are three classes of German submersibles—the ocean-going, the coastal, and the mine-laying. The latter is ocean-going.

An advance copy of "Jane's Fighting Ships" has been received. It places the number of mine-laying submersibles at 60. The mines are contact and of the most deadly type. Twelve to twenty mines are carried. None of the mine-laying submersibles carry torpedoes. The British knowledge of these boats is based upon the fact that one of them, the *U C-5*, was captured with ten mines aboard.

The later ocean-going submersibles have four torpedo tubes and carry 8 to 10 twenty-inch torpedoes. They also have one or two 3.4-inch guns and one or two machine guns. They are about 230 feet long and have a crew of about 40.

The submersibles of *U-20* and *U-40* type are also ocean-going. They are of 750 to 850 tons displacement, carry eight torpedoes, and have a cruising radius of 2000 to 3000 miles at a surface speed of 10 to 12 knots. The coastal types are of from 160 to 450 tons. They carry not more than six torpedoes, and have a radius of 1200 to 2000 miles under favorable conditions. They are, consequently, available for operations in the North Sea.

Germany has also a considerable number of experimental U-type boats, built 1902-1909. These carry three 18-inch torpedoes, and some of them have a cruising radius of as much as 1300 knots.

The Allies have to meet these, a swarm of minesweepers, scores of destroyers, a vast fleet of submarines, hydroplanes, many thousands of fast motor boats, each armed with one or two guns. They will also use nets and counter-mining.

[Naval Notes of the War. *Army & Navy Jour.*, Feb 17, '17. 200 words.]

German papers describe the new type of German submarines for extensive cruising as follows: tonnage, 2400; length, 260 feet; width, 25 feet; horsepower, 19,000; crew, sixty to eighty men; speed on surface, 26 knots; speed submerged, 14 knots; cruising radius, 8,000 miles; submergence permitted by strength of shell, 200 meters. It is said that one hundred submarines of this type are engaged in the present blockade, while a hundred more are in process of construction at Hamburg, Bremen, and Kiel. The German papers also assert that Germany has ten new submarines of 5000 tons, 400 feet length, and 18,000 miles cruising radius, whose armor and gun equipment are sufficiently heavy to permit them to engage in battle with the ordinary type of cruiser of similar displacement.

United States

See also
UNITED STATES—NAVY

—Bases for

Germany

[Discovery of a [submarine] Naval Base, Near Cartagena. *Heraldo de Madrid*, Feb 20, '17. 800 words.]

The finding of buoys, lettered U-19, by fishermen, near Cape Tiñoso, led to an investigation by the authorities. These buoys were afloat some 30 meters from the shore, and fastened by a strong steel rope to a large stone on the beach. Under water were found 31 cases, each containing 12 tins of gasoline, besides another case with papers and documents. On the beach was a small boat of peculiar construction. Fitted with two air chambers, its bottom carries two orifices, suitably tapped to receive hose or sleeves, and such that they may be closed when navigating. It

seems that in the German navy, these boats are called "funnel boats"; constructed to supply submarines even when submerged and under way on the high seas, they are carried on the decks of submarines when these are under way, and are equipped with small motors and even sails.

—Defense Against

[The Foundations of Victory. By Arthur Pollen, *Land and Water,* Dec 14, '16. 4100 words.]

With the appointment of Sir Edward Carson as First Sea Lord, the Board of Admiralty may be considered an entirely new body. Whether victory comes earlier or later, its final character must be conditioned by the way the work of the New Board is performed, for it is upon the sea, and what its use means, that the entire military fabric of the Allies is based.

The most urgent problem of the day is to counteract the operations of the German submarines. The present submarine campaign is marked by a novel character and the explanation of failure to deal with it as with previous campaigns, must be found in our offense being inferior to their defense in this respect. The position created by submarine attack has always called for four definite lines of action in reply. The most effective is the effort to keep them out of open waters by barricading them in their own; unfortunately, this is a line of action which is also the most hazardous and difficult.

The second includes the employment of nets, mines, patrol vessels, and a great variety of stratagems and devices unnecessary to specify. Third comes the better equipment for self defense of the victims that the submarines are after. Finally, there is the restoration of the losses suffered. The urgent need of building merchant shipping has been constantly insisted on. The efficiency in submarine work of eighteen months ago is now multiplied nearly by four and losses in merchant shipping are startling.

The proportion of neutral ships amongst those sunk is far higher than it used to be and the suggestion that neutrals should arm their vessels has been seriously discussed in the Spanish press. It is suggested that merchant vessels employ smoke screens to baffle and confuse the submarine. This proposal has been urged by naval officers, if not by the Admiralty, but so far without success.

If at the first sight of a submarine enemy, a merchantman could envelope itself in smoke and retreat on the course promising, in the prevailing wind, the best assurance of concealment, the work of the submarine commander would seemingly be greatly embarrassed. The obscuration of the target must cause misses and waste of ammunition. It would delay the destruction of the ship, thus allowing time for assistance to arrive. It might sometimes facilitate ramming. A submarine commander, unable to make distant gunfire effective, might hesitate to close thru a smoke screen. He might suspect that mines had been thrown overboard. He would not know if succor were near, or a ship seemingly unarmed were really a formidable enemy. If the screen should compel the submarine to close, a new value would be given to 12, 6, and even 3 pounders.

The suggestion should not be neglected as it must be many months before it will be possible adequately to arm every merchantman. It is possible that the best solution of all the shipping problems may lie in state control of all maritime concerns.

[The Protection of Commercial Steamers. By Admiral Degouy. *Revue des Deux Mondes,* Dec 15, '16. 6600 words.]

Submersibles and submarines have tremendously increased in size, speed, radius of action, and armament. There is talk of a submersible cruiser of 5000 tons, and it seems that some submarines are carrying 150 mm. guns in addition to their torpedoes. The large new types make 18 or 20 knots on the surface and 12 to 14 submerged. They have petroleum engines, or motors, whose fuel they can replace from any victim's store or cargo. They have most elaborate wireless equipment. German submarines have bases in many quite well-known localities, threatening all trade routes. Desite the vigilance of the United States authorities, they are probably in wireless communication with agents in that country, and receive information as to sailings, cargoes, descriptions, etc., of outgoing vessels. They doubtless do not too closely conform to the rules concerning territorial waters in watching for their prey.

How can ships be protected? Can they protect themselves? Can convoys be provided? What are the best methods to protect them?

The problem presents itself under two aspects. Protection is needed thruout the voyage in the smaller bodies of water. In the Atlantic, protection is particularly needed in getting out into the high sea, and in making land. The submersible high-seas cruiser has happily not yet appeared; but who can say that it may not be in process of construction?

As to self-protection, the guns so far in general use are smaller than those that seem to be borne by the new type of submersibles, which are apparently budding into bombarding war vessels. For the liners, many guns, gunners and skilled observers would be needed, as well as captains bold enough to fire upon the pirates, altho superiors recently condemned to death one who did fire.

For the shorter and more dangerous lines of travel, for example in the Mediterranean and the North Sea, it might help to follow unusual and varying courses, but the vessels should be convoyed out and in. For this duty, fast-sailing, small craft are best; we can not have too many.

Furthermore, the voyages should be shortened as much as possible. Why not make more use of mixed transportation? Many voyages could be shortened by utilizing shore transportation. In many places, by utilizing railroads and motor vehicles, the danger could be reduced 50%.

In the Atlantic, vessels should be well covered in getting away from land, and in making land. To do this effectively, careful and thoro organization would be necessary. Trying to ferret out submarines, especially when our cruisers must respect territorial

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waters while the submarines can disregard their limits and escape detection, is an almost hopeless task.

Here, too, convoys for the entire voyage would be best; but we always come into contact with *"established principles."* We can not get enough small craft, and we hear such objections as that of the retardation of fast-sailing liners by slower convoys. Better more time and greater safety. Besides, every sailor knows that the liner could tow her convoy, and she would not need to throw out a steel cable to do it. The smaller vessel could follow in her wake.

There are many minor means of lessening the danger to vessels. Are the least visible colors used for painting? Can the art of "making up" be utilized? What can be done by means of false water lines, false lengths for the ship, false heights for masts, smoke-stacks, etc.? All these details would have to be put into practice outside the port of departure. They could be done after sailing; one could put into certain convenient places for the purpose when the seas ran too high. The use of paint and other artifices like those mentioned would assist in misleading the enemy in his calculations of distance, etc.

Munitions should not be carried on personnel transports. There are enough explosives aboard for the guns carried as an armament in these cases. These, too, should not be considerable, and they should not be placed in the hold, where a mine or a torpedo may explode them. Better an explosion on deck than in the hold. Protective or palliative measures could be provided on deck, tho the probable inconveniences are recognized as serious.

Wireless telegraphy, collective and individual life-saving equipment, numerous carefully constructed ship's boats, perfected methods for promptly lowering the boats, notwithstanding any possible inclination a torpedoed ship might take—all these should receive our most careful attention. Means should be worked out for eliminating the smoke, which reveals at great distances the presence of a vessel.

In default of the means of providing convoys for the entire voyage, there should be organized a route of relay protection, over which a ship could pass from one protected zone, or from one safety lane to another. It will be noted that there is a striking resemblance between the methods that it would be well to adopt in the maritime theaters of operations and those already established on land in a warfare of movement. There are not two ways of waging war; there is only one, the proper way.

There is no intention here to open a discussion which will doubtless be brought up later. But it may be repeated that we shall not succeed in wresting from the Germans the undeniable mastery which they exercise, not on but under the sea, except by attacking methodically and successively, with all the appropriate means of action, the naval bases of their submarines, for the purpose of destroying them or hermetically sealing them up.

[Fighting the Submarine. *Army & Navy Gazette*, Feb 24, '17. 300 words.]

Commander Carlyon Bellairs writes that in order to combat the submarine peril England should send supplies for Salonika by land to Italy; build 500,000 tons per annum, convert passenger liners into cargo vessels, and gain 1,000,000 tons by the alteration of the load line; avoid military side issues to save tonnage; minimize the loss of ships' time in port; and buy from the enlarged shipbuilding plants in the United States and Japan.

[How U-Boats Are Hunted. *Army & Navy Jour.*, Mar 3, '17. 500 words.]

The English Channel is divided into sectors, each under the command of an officer who directs the search for enemy submarines by patrol boats and airplanes. When a submarine is discovered, the nearest destroyer flotilla is notified by wireless. The destroyers proceed to lower in the path of the submarine a wire rope net about 300 yards long and 100 feet deep, in which the submarine becomes inextricably entangled.

[The Submarine Problem. The Gun as an Answer to the Submarine. *Scientific American*, Aug 4, '17. 1300 words. Illustrated.]

The *Scientific American* believes that the only effective defense against the submarines is to shut them up in the North Sea by means of a continuous mine barrier from the Shetland Islands to the coast of Norway. The alternative is to hunt the submarines down on the high seas by means of destroyers and auxiliary small boats.

If the submarines are allowed to reach the seas, the best thing to do is to arm the merchantmen so that they have a chance to defend themselves. This is being done. The guns range from three inches to six inches in caliber. All available guns, not always of the most effective type, have been used.

The gun is particularly effective because the Germans have reduced the range and speed of their torpedoes in order to increase the explosive charge. This was all right until the merchantman was armed with guns effective at 5000 to 8000 or 9000 yards. Now the Germans are building larger boats mounting heavier guns. The latest submarines carry two 5.9-inch guns mounted in the open, heavily coated with grease to protect them when submerged. The 5.9-inch gun fires a 100-lb. shell, effective at 9000 yards. The conning tower of the latest submarines carries three inches of armor and it is reported that in some cases this conning tower is large enough to house the guns.

The proper course in any case is to mount guns of equal power on the boats that may come in conflict with these submarines. The 51-caliber, 5-inch gun is a splendid weapon for this purpose. Several thousand of these should be ordered. Armed with such guns, the advantage would be with the merchantman, with its greater steadiness, height of gun above water, and ability to stand perhaps several hits, whereas a single well-placed shot may destroy or disable a submarine.

All of this presupposes fighting the submarine in the

open, but the submarine campaign would be over shortly if the North Sea net were established.

[Defense Against Submarines. *Canadian Military Gazette*, Oct 9, '17. 200 words.]

The new defensive measures against submarine warfare are meeting with success. Dozens of ships have been saved by the smoke-box system with which the majority of the British merchantmen have been supplied.

A despatch says that Major Douglas Hamilton is perfecting a device designed to make it impossible to sink ships at sea. The details of the invention are in the hands of the allied governments. A ship equipped with the device will be tested by torpedo fire in the near future. The resisting power of the device is said to be one thousand times heavier than the heaviest torpedo or other projectiles made by the enemy.

[The Submarine Problem. *Scientific American*, Oct 27, '17. 1400 words.]

The destroyer is the ideal anti-U-boat craft. It is big enough to stay at sea in all weathers. It carries an armament, in our Navy, of several four-inch guns, and with its speed of from thirty to thirty-five knots it can dash down upon a submarine so swiftly as to put the enemy in peril of penetration by gun fire, or of being sunk by the depth bomb.

The depth bomb of the average type carries about 250 to 350 pounds of trinitrotoluol which is about the charge of the modern torpedo. Its effectiveness does not depend upon a direct hit upon the submarine, because its destructiveness is based upon the fundamental fact that water is incompressible, and that the shock of detonating a mass of high explosive under water is felt immediately in all directions—the effect diminishing with the distance from the bomb.

There is one device needed to enable the destroyer to rid the seas of the submarine pest—a sound detector of sufficient range to enable the destroyer to find and follow a submerged submarine.

—Defense Against—Aeronautic

[Aircraft Against U-Boats. By C. G. Grey, Editor of the *London Aeroplane* (in the *New York World*). *Flying*, May, '17. 880 words. Illustrated.]

The observer in an airplane can see, if the water is clear, some twenty or thirty feet into it from a point vertically above, and if such water is only forty or fifty deep, a submarine is not likely to dive beyond the visibility point. It is quite another matter, however, in the North Sea, where the water is a kind of leaden gray in color and where ten feet of water over the periscope is enough to hide a submarine as effectually as if she were twenty fathoms down. A patrol boat might well miss seeing a periscope half a mile away, especially if the periscope were between the boat and the sun, so that the reflection of the sun off the water was dazzling the lookout men. The aircraft observer, on the other hand, perched up aloft, would have a far better chance. Thus, seaplanes should have a far better chance of spotting the presence of submarines than could any escort of surface ships. An escort of "destroyers" or some similar type of armed ship is necessary, because the airplane or airship of to-day is not capable of carrying guns big enough to sink submarines with certainty, and the art of bomb dropping from aircraft has not become sufficiently a science to make the certainty of the bombs reaching their mark as great as is the certainty of a shell from a four-inch gun doing so.

Naval aircraft can cover an immense surface of sea in a very short time, to take enemy submarines by surprise while lying on the surface "airing" themselves, and charging up their batteries. On land one is generally warned of an airplane's arrival by the sound of its engines; but at sea the lapping of the water and the whistling of the wind thru rigging or round superstructure drowns the sound of the aero engine till it is fairly close. At night, in moderately fair weather, which is naturally the best for submarine operations, big seaplanes with searchlights could do much to keep submarines under water, and so add to their troubles by preventing them from stopping on the surface long enough to air their interiors and to charge their storage batteries. Big British flying boats patrol regularly from the east coast of England to the Dutch coast, near where it joins the German coast. It only needs an extension of such patrol systems to make life on the surface very unpleasant for enemy submarines.

[Submarine Hunting by Aircraft. By Henry Woodhouse. *Flying*, May, '17. 4300 words. Illustrated.]

Some months before the beginning of the great war, the British submarine *A-7* was lost near Plymouth, and an airplane was employed, among other means, to find it. The airplane proved to be the most efficient means for finding the submarine. The great war was only a few months old when the revolutionary value of both submarines and aircraft became evident. As the number of both submarines and aircraft increased, their operations extended more and more, and as the submarine menace grew, the nations had to meet it, and found that the aircraft was the best weapon for hunting submarines. Sir Edward Carson reported that since the commencement of the war the British navy had examined 25,874 ships. From the beginning of the war up to Oct 30, 1916, the British navy transported across the seas 8,000,000 troops; 9,420,000 tons of explosives and material; 47,504,000 gallons of gasoline; over a million of sick and wounded and over a million mules and horses. When it became necessary to build up a system of protection against submarines, the warring nations pressed into service thousands of small vessels, destroyers, trawlers and submarine chasers; and as fast as they could obtain them, they put into service seaplanes and dirigibles, to co-operate with the ships in locating and capturing and destroying hostile submarines; and in convoying ships, protecting them from submarine attacks.

The first report of an attack on submarines by an aircraft was issued by the German Admiralty on May 4, 1915. It stated that on May 3, a German naval dirigible fought several British submarines in

SUBMARINES—Continued

the North Sea and dropped bombs on them, sinking one. The submarines, the report stated, fired on the dirigible without success. Numerous other reports of attacks on submarines and sinking of submarines were made public in 1916, mostly successes of the Allied aviators. The policy has been to capture the submarines whenever possible. The report of one of the latest cases is where two submarines were enmeshed as the result of the co-operation between aircraft and trawlers. The U-boats were detected beneath the surface by a patrol seaplane. The aviator signaled for trawlers and circled about, directing the placing of nets. Soon these were drawn completely about the unsuspecting submersibles, which were brought to the surface. Hundreds of these aircraft are employed to co-operate with destroyers, trawlers and submarine chasers in capturing or destroying hostile submarines and searching coasts for submarine bases. The usual evidence of the submarine's presence is the wake of the periscope. This wake cannot easily be seen from ships, but can always be clearly seen from airplanes. For one thing, the aviator is not troubled by the reflection of the rays of light, which interferes with the vision of the person on a ship. The aviator, flying at a height of from 1000 to 5000 feet, has a range of vision of many miles, and the whitish wake of the periscope is clearly visible against the dark surface of the waters, even in cases where the sea is fairly rough and white caps are showing. In clear weather an aviator from a height of between 1000 and 3000 feet can also see a submarine under water. In clear weather and clear water, he can see the submarine even when it is at a depth of 100 feet. The *U-53* is 213 feet 3 inches long, and later ones are even larger. Such submarines present a very large track, and whereas their speed submerged is between 10 and 15 knots at most, the seaplanes, which go at a speed of up to 90 miles an hour, and even the seaplanes, which have a speed of only about 35 miles an hour, have an advantage over the submarines. If a submarine is seen under water, the aircraft, whether seaplane or dirigible, being equipped with wireless, and bombs, first send a wireless summoning destroyers, trawlers and submarine chasers. Whenever possible an opportunity is given to the trawlers or the ships which operate the nets to come up to the submarine and enmesh it in the huge net. That saves the submarine, and the crew is made prisoner. If a submarine finds itself in danger and submerges, it leaves an oily patch, which is clearly visible from the air, altho far less visible from a ship. Whereas the submarine cannot launch a torpedo without getting its bearings, *i. e.*, without showing its periscope above the water, it should be an easy matter for a seaplane to follow the course of a submerged submarine and attack it with bombs at the very moment the periscope pops out of the water. Considering that when a periscope shows the pilot has to decide how to act, and that unless the aircraft is flying low, it is hard to distinguish the features of the submarine from a height, one can well undersand why even naval men in different countries have found it hard to tell whether a given submarine was one of their own or the enemy's. The only way to prevent mistakes and not let hostile submarines get away is for the commanders to give the aerial submarine hunters information regarding the movements of friendly submarines operating in the locality. Hundreds of kite balloons have been used as lookouts for submarines in the great war. When they see a submarine or a doubtful ship, they summon the seaplanes, destroyers and submarine chasers by wireless. The employment of kite balloons as lookouts releases dirigibles and ships from continuous patrol of different localities which are equally well protected thru the work of the observers in the kite balloons.

[The Submarine Peril and the Remedy. *Flying*, Aug, '17. 2000 words. Illustrated.]

The nation has at last awakened to the fact that the peril of the submarine is not only tremendous but imminent. It has also realized that no adequate measures to remedy it have yet been attempted. The only remedy thus far proposed, which seems to have any prospect of giving the German machine a set back, is aeronautical attack.

The danger on the sea threatens the Allies more immediately, vitally and intimately—than does the danger on land, because it involves the commerce of the entire world and threatens soon to stop their supply of actual food and fuel. Altho major operations on both land and sea are now practicable with aircraft. no successes on land which can reasonably be expected within the next twelve months would weaken Germany much, whereas a successful attack on her fleet would ruin her. A torpedo discharged from a torpedoplane at a ship has the whole length and underwater body of the ship as a target and is fired under conditions practically identical with the conditions under which it is fired from a destroyer; so that it is fired under conditions in which naval officers have been trained.

The sinkings by submarines during the last five months have been so great that, should they continue to be as great, the Allies will then be in the hopeless situation that the Confederates were in during the closing months of the Civil war and from the same cause—a virtual blockade. During the last few months the Allies have gradually forced the Germans back towards the Rhine. It has been extremely slow, however, certainly not rapid enough to indicate that by the first of March, 1919, they will have forced the Germans back as far as Berlin—a distance of more than 400 miles.

It would be foolish to hope that any operations on the land will be able to save the Allies threatened by the submarine, and it would be equally foolish to expect salvation from any purely defensive measure on the sea. Unless the lessons of military history are misunderstood, we must end the submarine menace by attacking the submarine. The places where attack should be made seem to be Kiel and Wilhelmshaven, because they hold a greater amount of German mobile fighting power than any other places do and are nearer and easier to reach than any of the great strongholds

of the interior. One reason for putting faith in aeronautics is that even if the number and effectiveness of the German submarine should considerably increase, they would be powerless to prevent our sending aircraft to England, because ships carrying aircraft could launch them before reaching the localities where submarines would have much chance of finding them, and the ships carrying the aircraft need not go near the real danger zone at all.

—Defense Against — Motor Boat Submarine Destroyers

[The Destruction of Enemy Submarines. By Raymond Lestonnat. *L'Illustration,* Feb 10, '17. 900 words.]

The declaration of the blockade of the coasts of the British Isles, France and Italy made by our enemies leads one to think that they must have a great number of submarines to attempt so vast an operation. They will need many, for our allies and ourselves have not failed to take the necessary disposition to hamper and to destroy as many submarines as possible.

The consequences of any damage to the shell are always graver for a submarine than for an ordinary ship. A single hit, when it is navigating on the surface, may prevent it from submerging, thus depriving it of the faculty that constitutes its *"raison d'être,"* and may even sink it. A hit when it is submerged causes its loss because, since it has little or no margin of buoyancy, the least overloading sends it to the bottom. The absolute imperviousness of its whole shell is a condition of its life or death.

There are two means of destroying them: the snare and explosives. They are snared by means of a net. Nets give good results. The English have taken thus a large number of submarines of small displacement. But their installation and especially their maintenance —they deteriorate rapidly—demand a large personnel, considerable floating matériel and above all, much time. In spite of these disadvantages they are still being used, and their number is increasing.

Explosives—mines, shells or torpedoes—are in general use. Mines are for fixed defense as the nets are, with this advantage over the latter, which sometimes let their prey escape, that they surely sink the boat that strikes them.

The shell is the offensive engine of action at a distance, but, to sink or damage a submarine by gun shot, one must surprise it in good range, navigating on the surface, and have the good fortune to hit it in less than a minute, for it does not need any longer than that to disappear. Then it has nothing to dread but another submarine.

When the submarine is submerged, even if its periscope allows its immersion to be estimated, it is almost impossible to hit it with an automobile torpedo. The latter has a horizontal trajectory, having been built with a view of attacking vessels navigating on the surface. The natural tendency, then, has been to look for an engine capable of being exploded at a considerable depth and allowing the submarine to be attacked *vertically,* by flying above it or navigating under it.

Naval ai-planes for the hunting of submarines are furnished with bombs which they fire when the submarine is navigating on the surface or when the weather conditions, or the clearness of the water, allow it to be seen submerged. Several submarines have been sunk by this means.

On board destroyers and patrol boats, use may be made of large grenades, loaded with an extremely powerful explosive. They explode at the desired depth, by the action of a hydrostatic detonating mechanism. The effects are felt for a radius of 25 meters. At this distance, the plates of the submarine are dislocated, and the undersea boat sinks.

These grenades are used approximately as follows:

As soon as a submarine is sighted, the patrol boat heads for it at full speed and immediately opens fire with its guns. The submarine plunges to avoid the shots. From time to time, it puts its periscope above water to orient itself and to locate its adversary. The slight disturbance on the surface does not escape the practiced eye of the chaser. This is not the only indication that aids the pursuer; the submarine's own mass in motion creates on the surface of the sea a characteristic agitation that can be recognized by those experienced in this stirring game.

As the submarine does not go fast below the surface, the hunter, sure of catching up with it, is solely concerned not to lose track of it When the patrol boat gets above it, grenades are thrown into the sea, every 25 meters, the patrol boat continuing to move ahead. The engines thus laid in the wake of the hunter explode as soon as they reach the depth for which they have been regulated. When a large patch of oil appears, there is a strong presumption that the submarine has been destroyed. However, the enemy alone can be certain of this only when the U-boat is missing, and he is careful not to announce it.

The commanders of our chasers are very reserved, they never affirm the loss of a submarine unless they can prove it. So, all we know of their exploits are reports like the following:

"Brilliant maneuver of the X —— in the course of meeting an enemy submarine which it probably destroyed."

The frequency of these reports show the activity and skill of the officers and crews of our destroyer and patrol boat fleets. But the jealous sea guards their trophies.

[From the North Sea to the Atlantic. *Scientific American,* Mar 10, '17. 1100 words.]

The effective defensive measures against the smaller German submarines operating in the shallow waters near the coasts, such as the use of nets and the easy observation by airplanes, will fail in the deep waters of the Atlantic and the Bay of Biscay against the latest submarine craft. The answer to the submarine campaign inaugurated by Germany on Feb 1, should be a vast fleet of big, fast, sea-going motor boats, designed specifically for deep sea service as submarine chasers. Their minimum length should be

SUBMARINES—Continued

100 feet, their maximum speed, 30 knots, and they should mount on the fore deck a rapid fire gun of not less than 3-inch caliber.

[Plans for a Large Mosquito Fleet. *Army & Navy Jour.*, Mar 24, '17. 450 words.]

The Secretary of the Navy has directed the New York navy yard to proceed at once with the construction of sixty 110-foot coastal patrol launches adapted as submarine chasers. Also, proposals have been opened at the Navy Department for 200 or more of these vessels. The New York yard has quoted a price of $30,000 per boat, complete except for the engines. Delivery will probably begin in sixty to eighty days, when the boats will be delivered at the rate of one every three days.

The indications are that hundreds of private motor boats and yachts will be ready for naval service whenever they are called for by the Navy.

[Chasing Submarines with Motor-Boats. By Prescott Lecky. *Popular Science Monthly*, July, '17. 1800 words. Illustrated.]

The motor-boat submarine chaser was suggested to a British agent by Mr. Henry R. Sutphen, an official of a boat-building company and submarine company. The result was a provisional order for fifty boats 80 feet long, 12½ feet beam, 4½ feet draft, and 32 tons displacement. Two 220 h.-p. motors were to give a run of 850 miles at 14 knots or 700 miles at 19 knots, on a full capacity of 2100 gallons. The crew is ten men, armament one 3-inch gun.

This provisional order was confirmed and increased later to 550. Automobile methods of manufacture were adopted. Templates and patterns were made for every part. Three machine shops were kept busy turning out the motors. Most of the woodwork was done in Bayonne, N. J. More than eight and a half million feet of lumber was worked into parts in this shop. The material was shipped to Canada and there assembled in large assembling sheds. Delivery of material and parts was so timed as to avoid storage. In assembling, a separate gang of workmen performed each separate operation. Automobile assembling was reversed—the boats remained stationary and the gangs moved along.

Since the war began, the production has increased from three a year to three a day. Five hundred and fifty boats were completed in less than 550 days from the time the contract was signed. (Many items of the enormous bills of materials are listed to show the size of the task.)

The movement toward standardization began in 1905, when Mr. Sutphen's company built 120 mine-yawls for the U. S. War Department. Two years later, 33 thirty-foot mine layers of standard pattern were constructed, and subsequently 110 standard boats for the U. S. life-saving service. The submarine chasers had all necessary accommodations for the crew of ten men, fuel and ammunition storage. The sea-keeping qualities are excellent, but the fuel and food supply is for ten days only. Painted gray, they are invisible at three miles.

[Cease Building Submarine Chasers. *Army & Navy Jour.*, Aug 11, '17. 700 words.]

Following the recommendation of the General Board, the Secretary of the Navy announced on Aug 6 that the Navy Department would place no more contracts for submarine chasers, but that existing contracts would be carried out. All energies will be concentrated on building destroyers. A destroyer can now be launched ten months after the keel is laid.

The failure of the submarine chaser is attributed by navy officers to the development of larger, faster, and more heavily armed submarines. Fanciful stories are written about 5000-ton submarines being sighted. The largest submarines reported with any authenticity are of 1200-ton type, armed with two 5-inch guns. There is good reason to believe that there are about 200 submarines on the German naval list.

[Germany's Submarine Effort. *Scientific American*, Apr 7, '17. 1300 words.]

It is believed that Germany has concentrated all her shipbuilding efforts upon submarines, and will be able by manufacturing methods to turn out with her present facilities about 500 submarines every six months. According to the most reliable information obtainable, the Allies have destroyed about one hundred submarines in all. Therefore, if Germany can hold out on land, her submarine menace will steadily increase, and her chances for forcing the Allies to come to acceptable peace terms will increase unless greater efforts be made to combat the submarine campaign. It is to this immediate danger that the United States should at once apply its efforts.

—Defense Against—Nets

[Submarine Nets. *Business Digest*, July 4, '17. Quoted.]

Secretary Daniels on Mar 30 awarded a contract to the American Steel & Wire Co. of Philadelphia for the construction of 100 additional steel cable submarine nets at an aggregate cost of $188,100; the nets to be 12-foot mesh, 1500 feet long and 34 feet deep, and deliveries to begin within three weeks at the rate of ten nets weekly.

—Defense Against—Smoke Screens

[Note. *Army & Navy Jour.*, Mar 10, '17. 110 words.]

The device used on British merchant steamers to envelope themselves in smoke includes two drums that are attached to the afterdeck, one on each side of the ship. Each drum is filled with phosphorus. When the lookout sights an undersea boat, an order is given to fire the phosphorus in the drums, from which almost immediately heavy clouds of black smoke pour, entirely enveloping the ship, and leaving such a long trail that the submarine cannot locate the fleeing merchantman.

—History

See also

AERONAUTICS—HISTORY (Article: ". . . On Submarines and Aeroplanes in 1648")

[Inventors Who Have Tried to Construct an Undersea Boat. *Journal of Military Service Institution*, Jan-Feb, '17. 1500 words.]

(A history of the development of the submarine from 1749 to date.)

—Periscopes

See also

PERISCOPES

—Use of in European War

See also

EUROPEAN WAR—NAVAL POWER IN

[The Submarine War of 1917. By Admiral Degouy. *Revue des Deux Mondes*, Jan 15, '17. 5200 words.]

The Germans have said that it is to be war to the knife. We must therefore understand that the struggle, under the seas as well as on their surface, in the air as well as on the land, is to become one of the greatest ferocity, that the voice of pity is no more to be heard, and that what little remained of respect for international conventions is to disappear.

What more than they have already done, can our enemies do? For the belligerents there will be henceforth no warning from their submersibles even outside the zone of English territorial waters. The floating mines which they are turning loose in European seas, in direct contravention of international law, will bear disaster for months, even years after the close of the war. We must also expect our coasts to be devastated by German submersibles. We are now confronted by submersibles of a bombarding type. These can and will shell our small ports, our fishing ports, bathing places even, since the killing of women, children and invalids enters into their conception of a warfare of intimidation.

We must anticipate combined operations of submersibles acting in conjunction with aerial craft. Such operations have already been executed. We may therefore expect the appearance, before undefended or insufficiently defended ports, of divisions of two or three bombarding submersibles having aircraft to reconnoiter for them, and to assist them in their destructive work and in locating or giving warning of mobile land batteries or war vessels that might be directed to assist the places attacked.

There exists now a type of submersible that is equipped with an armored battery, constructed above an almost cylindrical shell, and consisting of an unknown number of guns of 120, or perhaps 150 millimeters, the part of the hull not protected by armor being below the surface of the water when the submarine is in action. These vessels have a speed of 24 knots on the surface and 16 knots submerged, a radius of action of 18,000 miles, and a displacement of 5000 tons (4000 or 4300) on the surface. It may be asked what will be the solution of the problem of supplying these submersible cruisers, if they are to operate on the navigation routes of the Atlantic. Isolated harbors available as clandestine bases will not be sufficient. May not a solution be found in attacking and pillaging undefended seaports? It may be said that the crews of even a division of these submersibles would be insufficient to serve as a landing force for the purpose of securing supplies. Yes, but there is a reply to this objection. There is the *Deutschland*. There is a submersible transport.

If the Germans have seen fit to construct a commercial submersible capable of carrying several hundreds of tons of merchandise, it is only reasonable to assume that they have conceived the idea of utilizing the idea for the transportation of troops. Will this idea be realized in this war? I do not know. It merits attention, however. It is no longer sufficient to shrug one's shoulders at such suggestions. Such an attitude has already proved sufficiently costly to us.

Moreover, a rapid sailing surface vessel might convey supplies. The *Moewe* has already proved that it is possible to slip thru the blockade.

Considering for a moment the submersible of 2000 tons which is already certainly in use, we find the following characteristics: total length 85 meters; four Diesel motors, giving 7000 horsepower, and a speed of 22 knots on the surface and 14 submerged; sailing distance 6500 marine miles,—twice the width of the Atlantic; six to eight weeks' supplies of fresh water and provisions; armament of eight tubes for sixteen torpedoes; fifty automatic mines; four guns of perhaps 150 or 120 millimeters, with provision for fire against aerial craft; upper deck lightly armored; two small boats; a crew of fifty men and five officers, two of whom are mechanicians.

The torpedoes carried are 55 centimeters in diameter, weigh more than a ton, have a speed of 40 to 50 knots, and range, 6000 meters; charge, 180 kilos of trinitrotoluene.

The automatic mine, with a charge of 165 kilos is even more dangerous than the torpedo; it explodes lower down.

The gun must fire a projectile of 23 or 24 kilos, possibly of 40 kilos if the guns are of 150 millimeters.

The submarines also carry bombs for the purpose of sinking light craft which they will bring to.

All these things being true, what can we do to oppose the enemy?

Our means of action must obviously vary with the political, geographical, and hydrographical circumstances of the various theaters of operations.

In considering the question of the number of submarines at the disposal of our adversaries, it must be granted that at present the production of them exceeds the losses. They now have, probably, 150 submersible craft. These will most likely be distributed as follows: 30 of medium size for the Mediterranean; 20 more for the coasts of Spain and Morocco, a few of these being utilized for the passages of the English, the Bristol and St. George's Channels; 50 of varying tonnage (small and large) for the North Sea, the Baltic, the coasts of Norway and the waters toward the White Sea; 30 of large size for the high seas.

SUBMARINES—Continued

We shall, of course, following official announcements already made, increase the number of our light boats; we shall gradually arm our commercial vessels, and provide them with wireless equipment; we shall also develop our naval aerial service.

This is, however, not all that is to be done. From the beginning the necessity has been recognized of breaking up the enemy's organizations of small bases for submarine supplies, fixed as well as mobile. There is at present much trouble, in this respect, connected with the coasts of Spain, where various activities are being carried on.

But I repeat that the difficulty of operating against the large submersibles, with their vastly increased radis of action, the increase in the time during which they can remain immerged, their increased speed, etc., is becoming much greater. The small craft, useful against small submarines, will not be sufficient to cope with the large sea-going submersibles. What succeeded in 1915 will not succeed in 1917.

We are facing the problem of dealing with a different class of submersibles, the veritable submersible cruisers.

We must do something new, and not content ourselves with developing old systems. This war is undergoing transformations every day. What can one do against an enemy that invents, or uses in a masterly fashion the inventions of others, if one does not also invent, and invent more and better than he? To catch up with Germany it is not sufficient to take one step in the same time that she is taking one.

Such are the grave problems confronting us to-day. When all is said and done, if the appeal to invention proves fruitless, it should be remembered that the masters of the seas still have at their disposal a radical means of finishing this submarine warfare.

[The War at Sea. *Army & Navy Gazette*, Feb 17, '17. 1500 words.]

Among the reasons why the Germans are dissatisfied with their submarine campaign is that the average daily loss of British ships is less than the average loss in the worst week of the 1915 campaign, when only one-tenth of the present number of boats were operating. Also, according to Sir Edward Carson, a very large number of German submarines have been destroyed. The *Daily News* asserts that the original submarine fleet was wiped out in 1915.

[A Submarine Survey. By Percival A. Hislam. *United Service Magazine*, Feb, '17. 5200 words.]

After two and a half years of war it may be truthfully said that very little has been learned of the possibilities of underwater agents as factors in organized naval warfare. Ships have been sunk by mines and by submarines, but so far in only a very casual way. The Dardanelles failure of March, 1915, is the only occasion on which more than one big ship has been sunk by mines in the course of a single operation, and altho the submarine has scored a number of successes in which two or more ships were involved, they were not of the first order as far as their influence on the sea affair is concerned. Among these incidents are the sinking of the *Aboukir, Hogue,* and *Cressy* on the 22d September, 1914; of the French destroyer *Fourche* and the Italian auxiliary cruiser *Citta di Messina* on June 23, 1916; and of the British light cruisers *Falmouth* and *Nottingham* on the 19th August. The only known instance of underwater agents having affected a naval engagement of importance was when the British battle cruiser squadron abandoned its chase of the Germans under von Hipper on the 24th January, 1915; and the opinion is that the chase would have been kept up much longer had it not been for the damage to the *Lion,* compelling Sir David Beatty to relinquish his personal supervision of affairs. There is daily evidence in the use of submarines for the destruction of commerce of their military effectiveness in one sphere of maritime war; but it is too early to conclude that these vessels do not possess the intrinsic ability to play a leading part in strategy and tactics of a more essentially military nature. The mine so far has been surprisingly ineffective, in spite of the fact that it has cost the British five battleships, three cruisers, and three destroyers. A great amount of energy is employed in sowing and destroying these machines, and it is possible that the war may bring a confirmation of Commodore Sueter's ten-year-old prophecy: "The future successful naval tactician will not be the one who places his fleet in the most advantageous position for gun-fire, but the one who can force his opponent over a skilfully mined area." There is no more definite knowledge of the price Germany is paying for its undersea warfare than is conveyed in Mr. Balfour's description of his losses as "important" in August, 1915. Mr. Churchill stated that at the outbreak of the war the number of submarines built and building for the German navy, or in Germany, was about fifty. Prince von Buelow, former German Imperial Chancellor, informed a neutral newspaper man in Geneva recently that since the beginning of the war Germany has built 225 submarines. Even if they were available, pre-war statistics would be of little value. It is obvious that if only one-half the applicable resources have been centered on the work of submarine building, the rate of output might well reach dimensions which in ordinary circumstances would appear fabulous. The chances are that two or three types, each with its special function, have been standardized, in which case there could be no reasonable limit to the rate of construction, allowing for the size and complexity of the craft under discussion. There is information to the effect that super-U-boats are being commissioned by Germany ready for sea, at the rate of two or three a week. They are exclusively of the type capable of ocean-wide radius of action, and fitted with torpedo tubes of the largest caliber. If the total of 127 submarines sunk or captured by the British is taken, as covering the period down to the end of March, 1916, it will be found that it works out to about one submarine every five days—a rate which cannot be regarded as satisfactory if and while the Germans

are turning new boats into service as rapidly as has been told, and the story cannot altogether be discredited.

The kernel of the German Chancellor's report in September, 1916, was this: "The Chancellor admitted that Germany could not build submarines sufficiently rapidly to keep pace with the losses sustained in submarines." Unfortunately there are no such facts to encourage such a belief. It cannot even be believed that Germany had given up the submarine campaign in August. The majority feel that Germany has not found, and is not likely to find, any more effective means of harrying England than those U-boats whose uselessness Herr von Bethmann-Hollweg is said so emphatically to confess.

[The Submarine Campaign. Editorial. *Army & Navy Gazette,* June 23, '17. 1600 words.]

One of the most marked features of the submarine campaign has been its intermittent character. Waves of energy recurred at intervals of two or three weeks at first and afterward at longer intervals. The areas of operations also changed with these waves. It was believed that the quiescent intervals were resting periods for the crews of the submarines, of which there were not enough to maintain continuous activity, and the shifts of locality were to preserve the element of surprise.

The first campaign was met and countered, and then the scene shifted to the Mediterranean where the military expeditions offered opportunities for more execution.

Similar tactics could be foreseen in the new campaign against shipping, knowing that Germany possessed more boats and of greater power and range, but the intermittent character of the campaign was still to be expected. February and March (1917) showed great activity. In April conditions looked serious. May saw a return to normal conditions. A recrudescence has now (June) occurred, aimed especially against large ships. The danger should neither be minimized nor exaggerated. Admiral Lacaze of France has said that the submarines cannot compel peace. Sir John Jellico has explained publicly the difficulties and how he hopes to surmount them.

[Naval Review of the Year. By Arthur Pollen. *Land and Water,* Aug 9, '17. 2000 words.]

It was clear from the first that the time would arrive when Germany would make her last effort to ward off a military defeat by an effective sea blockade.

It was assumed, however, that, as the attack was inevitable, an adequate defense would certainly be ready. The events of September, October and November brought a rude awakening and as December and January passed thoughtful observers began to wonder what would happen when, after the peace overtures had failed, Germany must make her final effort. In February the great effort was made, and for the past six months the merchant shipping of the world, whether British, Allied or neutral, has been undergoing destruction at an alarming rate.

Three years ago the enemy relied upon the losses which mines, torpedoes and Zeppelin bombs would inflict upon Allied warships in his hope of reducing the balance of sea power. He has now abandoned this hope and is trying the slower method of sapping British fighting strength by submarine work. He must deny England the sea he cannot use himself, or perish.

The question is, can he bring Allied shipping to the danger point before he is himself exhausted, and therefore militarily defeated on land? Only those can answer who know his power of further resistance, and English power of doing without shipping.

SUBSISTENCE

See also
Cooking, Military
Rations
Refrigeration
Water supply

[The Work of the Commissary Department During the Great Field Maneuvers of 1916, in Sweden. *Svensk Intendentur Tidskrift,* No. 1 and 2, '17. 5100 words.]

(A detailed account of the manner in which the troops during these maneuvers were supplied with food from day to day, what personnel, teams and auto-trucks were used and from what depots the stores were supplied. Also criticism of the way all this was carried out.)

[Feeding the Armies of Europe. By A. E. Taylor, *National Service,* May, '17. 3500 words.]

The problem of feeding troops must be treated as part of the general problem of feeding the nation. The subsistence of troops consists of two operations, collecting the foodstuffs in accordance with the best interests of the people as a whole, and utilization of the food so collected in accordance with the science of nutrition. This article deals only with the latter phase. The writer was in Germany and England during six months of 1916, and the article is based upon his personal observation.

The caloric content of the peace rations of the nations now at war varied between 3800 and 4400 calories per day. 1900 calories are needed to meet the heat production needs of a resting man. The remaining 1600 calories of a 3500-calorie ration, assuming 25 per cent efficiency, correspond to 170,000 kilogrammeters of work. A hard day's work corresponds to 170,000 to 200,000 kgm., and few occupations demand over 250,-000 kgm. per day.

Good physical condition, and especially sound feet, are important factors in the energy expended in marching.

A 4000 calorie ration would seem to be excessive for garrison use and indicates waste. Experiments by Chittenden show that 2500 to 2600 calories are sufficient to sustain the weight at moderate exertion. The caloric content of the U. S. garrison ration is 4250, varying according to articles selected between 3800 and 4600 calories. That of the travel ration is about 2650 calories.

The trench warfare on the western front corre-

SUBSISTENCE—Continued

sponds to moderate exertion, but it is frequently attended by exposure to cold and wet. The ration of the British and French soldiers has not been reduced during the war.

The German ration was reduced to 3200 calories per day in the winter 1915-16, at which figure it has since been maintained. The normal intake is about 3000 calories, and the prisoner of war ration in Great Britain is about 2800 calories. The writer saw many thousand German soldiers and they looked tanned, hard, and healthy. Very few were obese, but none were emaciated.

The motor kitchens have proven powerful factors, particularly in the utilization of minimum rations. A diet low in meat cannot be issued individually, and the best method of preparing meals of irregular and scanty ingredients is in the form of a thick soup.

Cold storage, canning and drying of vegetables, have permitted great improvements. Canned meats are also extensively used. In German prison camps it has been necessary to use continually from opened cans for several days, but no ill effects have been caused.

The fat components of the rations tend to fall, especially in Germany. The worst result comes from the fact that foods cooked and eaten without fats are unpalatable. Hard breads, biscuits, and crackers have been replaced by standard baker's bread. The field bakeries are as efficient as the field kitchens, and the bakers have learned to put a crust on the loaves that will preserve them in an edible state a long time.

Sugar is a valuable component of the ration, quickly convertible into heat. The tendency is to eliminate the use of alcohol in the trenches.

The food question must be treated in its larger aspect. Morale cannot be maintained on a full stomach at the front and an empty stomach at home. Our production of foodstuffs is so little in excess of our consumption that we must handle the subject with care.

[A Letter from France. By Aruède. *Jour. R. U. S. Institution,* Aug, '17. 4500 words.]

(An account of the operation of one of the railway station food stations in France.)

SUPPLY AND TRANSPORT

See also

Aeronautics—Transport by
Ammunition—Supply and transport of
Automobiles
Coast defense—Troops—Supply and transport for
Dogs
Entrenchments—Equipment (Article: "Wilson Mono-rail")
Field artillery—Ammunition—Supply service
Mobilization
Motor transport
Railroads
Refrigeration (Article: "An Ice-Making Plant on Wheels")
Roads, Military
Sanitary service—Medical supplies

Great Britain

[The Quartermaster Service in the British Army. *La Guerra y su Preparación,* Nov, '16. 18,000 words.]

(This is an extract from "The Times History of the War.")

Italy

[How the Italian Army Lives at the Front. By Lieut.-Col. Rodolfo Corselli, General Staff. *Riv. Mil. Italiana,* Aug-Sept-Oct, '16. 15,000 words.]

The Italian army is fighting in a vast theater, having a front of almost 700 km. Much of this theater is in the mountains, in regions so difficult that they would seem to be accessible to the eagle alone. Trenches are dug in icy ground, on the edge of the abyss. The mountains themselves are the most formidable enemy to be overcome. Imagination is outstripped by reality. In one of the occupied regions it began to snow on Feb 22, 1916, and continued almost without interruption for a month. The depth of the snow exceeded 6 meters and reached 7 meters on one of the roads.

An immense amount of labor is involved in carrying on military operations under such conditions. The soldier is not a machine; he requires the greatest care to keep him at his maximum efficiency. It is necessary to feed him, above all; to clothe him and shelter him; to tend him when sick or wounded; to furnish him with arms of the best kind; and to bring him news from home to keep up his morale. It is a true saying that war is fought largely on the roads in rear.

The most diligent care is given to the feeding of the soldier. The twenty-year-old boy at the front has a keen appetite. The winter ration includes bread, beef, pastry, rice, potatoes, cheese, chocolate, chestnuts, dried fish, condiments, coffee, sugar, and wine. To the troops in the mountains there is an increased allowance of bread and wine, and a distribution of rum or other similar drink. Many special articles of equipment have been supplied for the purpose of insuring hot meals to the soldiers in the mountains.

The water supply was also a difficult problem, due to the contamination or freezing of springs. Filters and sterilizing appliances were furnished, and in some instances water was carried by pack animals and automobiles.

Questions of clothing and equipment were of the highest importance. To prevent extreme suffering and even death, it was necessary to make liberal distribution of flannel shirts, woolen socks, drawers, scarfs and gloves, cloaks, hoods, puttees, and double and triple blankets. Men specially exposed, such as sentinels and videttes, had fur coats, chest protectors, leather bags, all kinds of footwarmers and handwarmers, and hot water bags to be carried in the pockets and even in the hands.

Particular attention was given to foot covering, with a view to preventing freezing. It was considered highly necessary to keep the feet dry. Issues were made of special mountain shoes and boots, heavy overshoes, impermeable cloth socks to be worn over the woolen socks, and shoes with an impermeable lining of cows' bladders.

The advanced troops were protected from the weather as much as possible. The walls of the trenches were covered with matting; the bottoms were paved with stone over which a wooden floor was laid; more secure shelter was found in dugouts, blinded trenches, and sometimes in natural caves.

The principal method of lodging the troops was in cantonments. The magnitude of the task can be imagined, to provide shelter for half a million men and 80,000 animals. About 8200 buildings were erected, of every shape, style, and dimension, some of brick, some of cement block, but the greater part of wood.

In the most advanced positions, diminutive portable barracks were built, called by the soldiers *dog-houses.* They sheltered two men acting as videttes; when the house came under fire the men picked it up and carried it to another position.

To give an idea of the labor involved, it may be noted that a single army corps, in the mountain region, required 300,000 feet of lumber, of which a good third was transported on pack animals and in the last stages on the shoulders of the men.

The sanitary service has been handled with great care. The assemblage of large masses of men in a restricted space favors the spread of infectious and contagious diseases, such as smallpox, typhoid and cholera. As a rule a mean daily sick rate of 4 per 1000 is expected; the rate in the Italian armies, in spite of the difficult conditions, has been 2.22 per 1000. The principal diseases have been typhoid, mumps, measles, and ophthalmia; a few cases of scarlatina and erysipelas; and a very few of meningitis, tetanus, and smallpox.

The duties of the sanitary personnel have been heavy, especially after severe engagements when the number of wounded taxed the sanitary resources to the utmost limit. The sanitary corps has been recruited largely from civil life, with university professors and their assistants, specialists in various lines, practicing physicians, medical students, and so on. Some of the most noted men in the profession have contributed their technical knowledge and administrative ability to the military service.

The consumption of artillery ammunition, especially of the larger calibers, has reached startling proportions. In one of the earlier months of the war, when operations had not reached a large development, there were fired 40,000 rounds with mountain guns, 197,000 rounds with field guns, and 62,000 with large calibers. In a later month about 1,000,000 rounds were fired with all calibers. A single army has used 40,000 projectiles in a day.

The amount of material required for the engineer service has been correspondingly large. Every nation, except possibly Germany, was caught unprepared at the beginning of the war, and found its industrial establishments nothing like sufficient to meet the demands.

Like other nations, Italy has been forced to carry out immense projects of organization of industry. She has trebled and quadrupled the output of existing establishments and has created new ones, and is now able not only to supply her own needs but also to furnish some classes of materials to her allies.

The duty of taking all this material to the front falls upon the services of transportation, storage, and road maintenance. The civil engineering personnel has charge of the maintenance and improvement of existing roads and the construction of new ones. In the mountain country in the vicinity of the enemy, the roads are improved and maintained by the troops, and are used by bicycles and motorcycles, by auto trucks carrying from 2200 to 3300 pounds, and by wagons carrying from 1100 to 1800 pounds. In the more inaccessible regions the supplies are carried by pack mules, and finally by files of porters bound to one another with ropes.

Aerial tramways have been installed in some places.

The use of railroads has been notable in that the military transportation has not interfered seriously with the commercial use of the roads. The greatest number of men transported by rail in one month was 450,000, and in one day 18,000.

The number of men transported by water since the beginning of the war is 400,000, and of animals more than 53,000.

The militarry activities of the nation are controlled by an immense system of administration that reaches to every part of the country and collects the supplies, and on the other hand reaches to every part of the army and distributes them. Every effort is made to anticipate the needs of the different branches of the service and to have on hand the supplies required to meet every emergency.

Reinforcing and supplementing the official activities are the labors of the millions at home engaged in the work of the Red Cross and similar organizations. Everyone from the humblest citizen to the highest in the land is giving his aid to the war.

[Organization of the Supply Services in the Italian Army. *La Guerra y su Preparación*, Nov, '16. 8000 words. Diagram.]

(This article is continued from the October number of the magazine, which was not received from the publishers. Since the supply services of the artillery, engineer and veterinary corps are described here, it is probable that the missing installment contained descriptions of the quartermaster, commissionary and medical supply services.)

The Artillery Supply Service

In the Italian army, the artillery supply service is an organization quite separate from the artillery arm. Its function is to produce and distribute arms, munitions, explosives, wagons and harness, and also to provide all mobilized commands with the necessary animals, as well as to supply instruments and intrenching tools to all troops except engineers.

The territorial establishments of the corps are:

Two factories for small arms, Brescia and Terni.

Three arsenals for the manufacture of artillery and projectiles, Turin, Piacenza and Genoa.

SUPPLY AND TRANSPORT—Continued

Two arsenals for the manufacture of gun carriages, wagons and harness, Naples and Turin.

One powder factory, Fontana Liri.

Two arsenals for the manufacture of cartridges, Bologna and Capua.

One laboratory for telemeters, goniometers, etc., Rome.

One proving ground at Ciriè.

In addition to these establishments there are at present the large number of commercial factories taken over by the Secretary for Arms and Munitions to meet the enormous demands of the war.

FIELD SERVICE—ORGANIZATIONS AND ESTABLISHMENTS

The First Line

The organizations in the first line are those accompanying the troops, an ammunition column with each division and with each corps, an additional ammunition column for corps troops, and a corps artillery park.

The ammunition column is composed of three sections for artillery, corresponding to the three groups of the divisional regiment, and two sections for infantry, corresponding to the two brigades. The infantry sections include wagons carrying ammunition for the machine-gun sections attached to the regiments.

A section for artillery of 75 mm. has: one piece, complete, one battalion wagon, six wagons carrying shell, ten carrying shrapnel and two caissons.

A section for infantry has: one battalion wagon, eleven small wagons and ten large ones for cartridges and one wagon for each machine-gun section in the corresponding brigade.

The column also includes: two transport wagons, one forage wagon, one field forge and one wagon with tools for the 75 mm. piece.

The ammunition column for a cavalry division consists of: five wagons for machine gun ammunition and six for the cavalry, two 75 mm. guns, five ammunition wagons for artillery, four caissons, one tool wagon, one baggage wagon with field forge, one forage wagon, and three transport wagons for material, explosives and intrenching tools.

The artillery park of the army corps is made up of as many groups as there are ammunition columns in the corps, each group having as many sections for artillery and as many for infantry as the corresponding ammunition column.

In these groups each section for artillery has 12 small ammunition wagons, four of which are for shell, and six large wagons of which two are for shell.

A section for howitzers has 16 ammunition wagons.

A section for infantry has seven small wagons and eight large ones for ammunition.

In addition to these sections each group has one battalion wagon, one transport wagon and one forage wagon.

The park wagons are: two battalion wagons, two transport wagons, two bread wagons, two field forges and two wagons for general use.

Second Line

Advanced stores of artillery.

Central artillery depot.

Central live-stock depot.

Third Line

The territorial establishments and centers of production.

AMMUNITION SUPPLY

From the various sources of the country munitions flow into the central depots and from there are sent forward to the advanced stores of the army. The advanced stores supply the parks of the various army corps and the parks supply the division ammunition columns.

The ammunition of the foot soldier is replenished from the infantry sections of the division ammunition columns which advance the small wagons for this purposes as far as the conformation of the ground will permit.

The artillery is supplied with ammunition by means of a change of caissons. These are in two echelons in rear of the pieces. When the supply of the first line of caissons has been exhausted it changes place with the second line and is refilled from the wagons of the ammunition column. If the supply of both lines of caissons is exhausted before the wagons from the columns can get up, recourse is had to the ammunition in the limbers of the pieces, which is considered the last reserve.

The commanders of the various units indicate the positions to be taken up by the ammunition column sections corresponding to their organizations, changing them during the action so as to keep the ammunition always as near the troops as may be possible.

The ammunition columns are supplied from the park, the commander of the latter being kept constantly informed as to their movements.

Supply of Ammunition in the First Line

For divisional field artillery, the battery consisting of four pieces and twelve caissons:

	Rounds.
In the limber of the piece	32
In the caisson	96
Total per piece in the battery	320
(256 shrapnel and 64 shell).	
In the ammunition column	213
In the park	96

Total number of rounds per piece, 629.

For 149 mm. howitzers, four pieces and eight caissons in the battery:

In the caisson	24 shell and 8 shrapnel
Total rounds with the battery	48 shell and 16 shrapnel
In the ammunition column	64
In the park	72

For infantry:

	Rounds.
On the soldier	168
On the wagons	24

In the ammunition column	108
In the park	70
Total	370

For machine guns, per section:

On the pack-mules	4800
On the reserve pack-mules	4800
On the personnel	8400

(When not in action the above is carried on the two wagons for arms and matériel of the section.)

On the ammunition wagons	14,864
In the ammunition column	35,316
In the park	17,000

Engineer Supply Service

This service supplies all the various engineer units with the necessary equipment, including transportation.

The method of supply in campaign is similar to that of the artillery service already described. From the various sources in the country engineer equipment comes into the central depots and is thence sent forward to the advanced engineer stores. These advanced stores supply the engineer parks of the army corps and the parks provide the equipment for the engineer units and parks attached to the troops at the front.

The units at the front are as follows:

With each infantry division:

One company of sappers, five officers and 200 men, with its park, telephone park and bridge section.

With each army corps:

One telegraph company with its park.

With the armies are companies of engineers for fortification work, with parks; but during mobilization they are used independently at the front, by platoons and sections. The company consists of five officers and 200 men.

Each of the units mentioned is accompanied by its park, which carries the equipment necessary for its own special kind of work. The park of the sapper company has eight light wagons and carries picks, shovels, explosives, etc.

The telephone park, attached to the divisional sapper company, is served by a section of the company and has five two-wheeled carts carrying field telephones and wire. It connects division headquarters with those of the brigades and the artillery groups.

The bridge section of the divisional sapper company has seven wagons carrying pontoon equipment.

The telegraph company with the army corps has a park of 18 wagons carrying field telegraph stations, field telephones, wire, posts, insulators, visual signalling stations and equipment, etc.

The engineer park of the army corps has 13 wagons with equipment to replace that of the parks already mentioned. It has a field forge, a transport wagon and one battalion wagon.

The advanced engineer store uses motor trucks for transportation. It has:

One sapper park:

One bridge section,

One telegraph park,

One telephone park,

and such tools, explosives, airplane equipment, etc., as it may be necessary to send forward to the army corps parks.

The engineer troops apply for equipment and supplies to the chief engineer officer of the army corps, whose park is in turn kept supplied on application to the chief engineer officer of the army.

Transportation of supplies is done by the units concerned. From the advanced stores to the artillery corps parks, the transports of the stores or the parks are used, according to the distance, or the supplies are brought up by the auto-truck columns scheduled to make trips at certain times.

VETERINARY SERVICE

This service quarters and treats sick and wounded animals; cares for the hygiene of the stock, including beef on the hoof, of the parks; guarantees the good quality of meats and forage, and attends to the supply of veterinary material. It works under the quartermaster of the army.

The method of supply is similar to those mentioned for the artillery and engineer. From the central military pharmacy and the various centers of production, the supplies go to the central depot. The latter serves the sanitary service as well, and is located near the base hospital. It sends supplies forward to the live-stock infirmaries and to the veterinary wagons with the army corps.

Infirmaries are assigned to armies, generally at the rate of two to each army corps, each one accommodating 150 head or more.

In addition to these there are a number of fixed infirmaries and aid stations which are organized almost entirely from local resources.

With the various units there are veterinary officers who visit the sick animals and treat the ordinary cases. They keep constantly on hand a complete stock of supplies from local resources or by requisitions on the veterinary office of the army corps headquarters.

Matériel

a. Medicine sack for battery of field or mountain artillery, carried in a limber.

Pair of sacks for a squadron of cavalry, carried on the saddle of the veterinary officer's orderly.

b. Box for battery of mountain artillery, carried on pack mule.

Medicine chest for cavalry, carried in the baggage and field forge wagon.

This equipment is used for first aid to the sick and wounded stock.

c. Reserve supply of matériel of the army corps. This supply is carried in the section of the train assigned to the army corps and is used, in cases of urgent necessity, to replace stores used up by the troops.

During an action the veterinary officers strive to keep the animals in condition to do their work until the end of the combat at least. After the battle the veterinary service is carried on in conjunction with the other work of cleaning up the battlefield.

SUPPLY AND TRANSPORT—Continued

The infirmaries for stock are located not more than two days' march from the troops and near a line of fixed stations. The evacuation of the infirmaries is made on the nearest of the fixed aid stations.

United States

[Note. *Army and Navy Jour.*, Feb 10, '17. 150 words.]

The Secretary of War has ordered the Quartermaster-General to proceed at once to replenish the $30,000,000 worth of Regular Army and reserve supplies that have been exhausted by the recent activities of the army on the Mexican border and thru the mobilization of the National Guard.

[Bids for Army Supplies. *Army & Navy Jour.*, Mar 10, '17. 450 words.]

The new plan of purchasing supplies for the army with members of the U. S. Chamber of Commerce acting in an advisory capacity was tried out on Mar 5, when bids for tents, clothing and other equipment to the value of $15,000,000 were opened in six large American cities. In addition to their advice as to whether bidders were in position to handle the contract they sought, the civilian experts rendered invaluable service in interesting new bidders.

[Sufficient Supplies . . . Assured. *Official Bulletin*, July 6, '17. 1000 words.]

Due to the action of Secretary Baker, who assumed the responsibility of ordering supplies when no money had been appropriated, sufficient supplies for the national guard and national army are assured. The troops sent to France took six months' supplies with them.

Clothing and tentage have offered the most difficult problems. It was originally planned to build 32 wooden cantonments due to belief that tentage could not be supplied. The later decision was to reduce the number to 16 and make each cantonment larger. This was made possible by an improvement in the tentage situation.

Contracts for all necessary supplies have been placed, and deliveries have been promised prior to Sept 1.

National Guardsmen will receive their supplies at State mobilization camps. The dates for mustering into the Federal service—July 15, July 25, and Aug 5—are the dates for starting for the southern training camps.

[Huge Figures Showing the Scale of Army Operations at Present Time Are Given. *Official Bulletin*, July 5, '17. 300 words.]

The scale of army expenditures at the present time is indicated by the following comparison:

Article.	1915.	Present time.
Aeronautics	$450,000	$47,000,000
Subsistence	9,800,000	133,000,000
Regular Supplies	10,000,000	110,000,000
Transportation	13,000,000	222,000,000
Clothing, C. & G. E.	6,500,000	231,500,000
Ordnance	300,000	2,650,000
Arms	450,000	55,000,000
Ordnance Stores	700,000	106,500,000

The following purchases have been authorized: 5,000,000 blankets, 37,000,000 yards of bobbinette, 2,000,000 cots, 45,500,000 yards of olive drab cotton cloth, 21,300,000 yards of unbleached drilling, 6,000,000 pairs of shoes, and 11,091,000 pairs of light woolen stockings.

SURGERY, Military

See also
WOUNDS

—In European War

[War Wounds. By Capt. and Surgeon F. Blanchod. *Rev. Mil. Suisse*, Jan, '17. 5500 words. Illus.]

War surgery before the present war was based principally on the experience of the Russo-Japanese and Balkan wars. It is summed up thus: Asepsis and Waiting.

Asepsis, that is to say, to put no microbe-killing preparations on the wounds. The latter are often sterile and these preparations kill as many healthy cells as microbes.

Waiting, that is, not to be too zealous, to let nature work; it often repairs by itself the damage done by a projectile.

These principles had found their application in the individual first-aid packet which, applied by the wounded man or by a comrade, was to prevent practically aseptic wounds from being contaminated later by the clothing, dirt, handling, or any other source of infection.

The French surgeon, Major Matignon, who followed the war operations from the Japanese side, reports that Japanese soldiers, struck by Russian 6.5 mm. bullets, would often continue to run after being hit and that numerous wounded, after weeks of different kinds of transportation, arrived in Japan cured without surgical attention.

These observations are explainable by the fact that in the Russo-Japanese war, as in the Balkan war, the great majority of the wounds were produced by rifle bullets, a small number only being due to artillery projectiles. Thus, at the battle of Liao-Yang, 97.90 per cent. of the wounded of the 2d Japanese division were hit by rifle bullets, 2.10 per cent. only by shell fragments or shrapnel bullets.

It was currently concluded that the artillery's effect was rather moral and that the improvements in it had not increased the deadly effect of the cannon. The artillery, in circumstances which were most favorable to it, had not produced more than 10 to 15 per cent. of the losses.

It was also concluded that the modern bullet, called humane, caused mortal lesions when hitting a vital organ, the brain, the heart or the large vessels, or caused a minimum of damage in going thru accessory organs.

In the present war, beginning in the month of August, 1914, the whole surgery of the war was over-

turned and transformed brusquely by the fact that the great majority of the wounds are due to the effects of artillery.

On account of the conditions of this war,—cannon of all calibers always more numerous, the pounding of the trenches, the lengthening of the fire to reach the reserves, "barrage" fire,—the figures are approximately the same in the two armies: 80 per cent. of the wounds are due to shell fragments and shrapnel bullets, 20 per cent. only to rifle or machine-gun bullets.

Now, the bullet sterilized by friction in the rifling, penetrates the tissues at high velocity and, in 70 per cent. of the cases at least, goes entirely thru the organism, leaving only a course with clean cut edges not very favorable to infection. On the other hand, the shell fragment, with irregular edges, arriving at low velocity, penetrates the organism with a twist, tears the tissues and carries to the bottom of the wounds pieces of clothing or leather, particles of earth or wood, rarely goes clear thru, and remains as a source of infection in the lacerated and stupefied tissues, which are ready then to serve as a medium for microbe culture.

The cause of the wounds having changed, the formula of Nussbaun, which had the force of a law: "The fate of a wounded man depends upon the first dressing applied," becomes false. For, carefully to put a first-aid bandage on a wound at the bottom of which are foreign septic bodies is like putting a plaster on a wooden leg.

The principle of waiting and not interfering resulted in virulent infections, blood poisoning, gangrenes, which defeated the most experienced surgeons at the beginning of the war.

* * * * * * * *

Three distinct periods must be distinguished in the evolution of the sanitary service in France since the beginning of the war. In August and September, 1914, on account of lack of means of transport, the wounded came to the surgeons of the base hospitals (insufficient in number) several weeks after having been hit. The wounds, which had been treated by a simple bandage, were in a frightful state of infection. Several French surgeons and the Swiss surgeons, who then offered their services to France, have told of the nauseating odor of fermenting sauerkraut which filled the wards, of pus running thru the bandages and the beds, of worms swarming in the wounds. Shell fragments and shrapnel bullets, by their resemblance to grape shot fragments and to large caliber lead bullets, brought modern surgery back to the septic surgery of Napoleon's time. And modern surgeons, in August and September, 1914, could only apply the advice of Percy, chief surgeon of the Grand Army, "to make large incisions and open a wide passage to the investigating finger which goes in search of the bullet."

In 1914-15, the necessity of operating rapidly on all the wounded hit by an artillery projectile caused the French sanitary service to improvise numerous hospitals in the great centers of the interior. Two or three days after having been hit, the wounded reached these centers by automobile transport and by sanitary trains. The model of motor ambulance adopted can hold nine wounded men lying on stretchers suspended on springs. The admirable organization of the whole sanitary service in the rear greatly improved the lot of the wounded. The gravest cases only were retained in the hospitals of the zone of the armies. All the others were sent to the interior. No more worms were seen in the wounds, but all the wounds were still infected. Septic fevers and suppuration continued interminably in many cases.

Experience showed that the only manner of avoiding infection was to remove the shell or grenade fragments soiled with earth, the pieces of clothing, in six or eight hours after the wounds, that is to say, before the microbes had swarmed and penetrated the tissues deeply. Without being afraid to reverse its judgment, the French sanitary service (and that is the evolution of 1916) diminished the importance of the hospitals installed in the rear at much expense and created in the zone of the armies division hospitals for operating on the wounded without delay. We have seen, on the Champagne front, subterranean hospitals, long vaulted corridors covered by several meters of earth, which have resisted so far all the enemy's artillery bombardments. The equipment is perfect; operating rooms, sterilizers, X-ray, and electric light, permit surgical aid to be given with a maximum of security.

A mobile surgical group, comprising six surgeons and improved matériel transportable in two autos, is attached temporarily to the busiest hospitals. The cases which, in spite of prompt operation, need further care, are sent to the hospitals in rear.

The method of wound sterilization practiced everywhere in France now is that of Carrel, the remarkable French surgeon who distinguished, in peace time, the Rockefeller Institute in New York. This method consists in the constant application to the wounds of Dakin's liquid, which is a solution of hypochloride of soda, having the antiseptic properties of the well-known Javel water without its caustic action.

The preparation of the wound consists in opening the soft parts wide, especially when there is a fracture, and cleaning them mechanically. The wound is explored and foreign bodies, pieces of clothing, projectiles, pieces of bone, blood clots and mortified tissues are removed. Hard rubber drains, 5 to 8 mm. in diameter, communicating with the exterior are placed in the tissues. Constant irrigation is made with Dakin's liquid. In 8 to 15 days, the greater number of wounds are sterilized and, by subsequent operation, a healing by first intention may be obtained.

This is very far from the application of the individual first-aid packet that was thought to be sufficient for everything.

Head Wounds

Altho, in the Russo-Japanese war, the wounds of the head and neck represented 15 per cent. of the war wounds, these wounds are infinitely more frequent in the present trench warfare. The adoption of the helmet in the Allied armies saved a considerable number

SURGERY—Continued

of the wounded from death. We have seen in the hospital of the Russian brigade, north of Chalons-sur-Marne, a collection of helmets pierced by shell fragments. All their wearers had been saved by a prompt operation, the projectiles stopped by the helmet having merely crushed in the skull without penetrating the brain deeply. The Germans have adopted for the especially exposed watchers a large helmet which is highly spoken of.

The usual operation in trepanning. The wound is enlarged, the hole in the bone trimmed, the pieces of bone removed, and the brain drained. The resistance of cerebral matter to infection is perhaps one of the most curious medical facts brought out by this war.

The medical press has told of a great number of wounded cured of a suppurative hernia of the brain caused by a fracture of the skull. We remember a wounded man whose cerebellum was literally bathed in a lake of pus. He was cured after several weeks' drainage.

They have learned to mistrust small grazings of the skull which do not appear to be serious. Often the inside surface of the bone is damaged. After a little while, the irritation of the cerebral envelope gives rise to epilepsy. These cases are to-day systematically trepanned.

Wounds of the Face

Looking out of the loophole, the soldier is often hit in the face. The eye is removed from its orbit, at other times the face is seriously mutilated. The wounds of the face are especially impressive to see; the tissues being very full of blood vessels and very elastic, swell and become deformed more than in other parts of the body.

These wounded are taken to hospitals specially fitted up for plastic surgery. We have visited those of Paris, Lyons and Berlin. During the period of infection and elimination of mortified tissue the wounded who have the lower part of the face torn away are fed by a tube. When the healing process begins, skilful surgeons graft in a piece of leg bone or rib, of which they improvise a jaw. Cheeks are most often furnished by strips of skin taken from the arm. Mutilated noses take on again a human form by injections of paraffine.

The neck is an especially dangerous region on account of its great blood vessels and nerves.

Chest Wounds

Rifle bullets frequently go clean thru the thorax without producing infection. If the pulmonary tissue is only pierced, the wounded man generally stands the resulting hemorrhage. A puncture of the pleura evacuates the blood, the anguish produced by difficult breathing disappears little by little, and the wounded man can return to the front after a few months' convalescence.

Shell fragments cause much more damage. They lacerate the lung and provoke serious infections. Death from blood poisoning is prevented only by cutting a hole in the ribs and drainage on a large scale. An aspirating machine empties the pleura of pus as it forms. Long suppurations of the thoracic cavity render the patient anaemic.

Wounds of the Abdomen

It was generally conceded before the war that a great many of those wounded in the abdomen died before being taken up, others succumbed to peritonitis and quite a large proportion might get well if let alone. Almost all those who were operated on succumbed. In practice the wounded man was to be abandoned on the battle field after an injection of morphine, it being considered that time could be more usefully spent on other wounded.

At the beginning of the war, most of those wounded in the abdomen succumbed. To-day they are operated on near the front with success.

The Germans have adopted the same method of speedy operation and one may see at the ***kriegsärztliche ausstellung*** in Berlin how the German surgeons transform a little room in an inn into a model operating room. This institution is interesting; everything that has been proved useful up to date has been assembled there, and doctors leaving for the front go there to be instructed.

Lesions of Blood Vessels

Aneurism is the name given to the communication created between an artery and a vein. Arterial blood under pressure penetrates the vein and distends it. The rifle bullet produces local aneurisms which are not very dangerous.

Those caused by shell fragments are of greater extent and cause serious hemorrhages. Transfusion of blood is practised for the resulting anaemia. In several hospitals, we have seen lists of people, who, not being able to serve their country in any other way, may be called any moment to give their blood to a wounded man.

Lesions of the Spinal Cord

Some cases of pressure on the spinal cord are curable, if operated on early enough.

This war has revealed a curious class of wounded which is illustrated by the following case: A large caliber shell bursts near a man without wounding him. The man becomes unconscious, falls and is picked up in a state of coma. After 18 hours, he comes to. The muscles about the backbone and neck are contracted; his hands are clinched; his skin and scalp are unduly sensitive. The man stays dazed for several weeks; he does not sleep and eats very little. In some cases, when the man comes out of his coma, he is paralyzed on one side. At the beginning of the war, this was thought to be due to hysteria. At the present time, the puncturing practiced in these cases reveals a hemorrhage in the spinal fluid which compresses the nervous elements of the cord. Repeated punctures afford great relief and often effect a cure.

Lesions of the Nerves

When a nerve is cut, the two ends are sutured together. It takes 6 to 18 months before the least sign of nervous conduction is observed.

Fractures

Shell fragments and shrapnel bullets literally mash bones. Every such wound should be cleaned and drained. Prompt immobilization being the first condition of a good cure, fractures have a better chance now than at the beginning of the war. There is a great deal of trouble with adhesions. There are at Bordeaux and Lyons hospitals for the re-education of these wounded by massage and electricity. These men are kept there for some time because, if they were sent home, progress would cease and complete ankylosis result.

Experience has determined the doctors to wage a real war against crutches. The wounded who are deprived of them at first do not seem willing to walk, but one sees them soon hop from bed to bed to go and play a game of cards with their neighbors. A few days later, they go out with a cane.

A staff doctor attached to the Ministry of War in Berlin assured us that, thanks to mechanotheraphy, 80 per cent. of German wounded return to the front, a figure impossible to verify evidently, but significant for those who calculate losses.

The most serious fractures are the high fractures of the femur. It is absolutely necessary that some extension apparatus be used, else there is a shortening of the leg of from 15 to 20 centimeters. These fractures are now treated close to the front. New extension apparatuses have replaced the weights.

Fragments of bone are subject to the general law that every infected foreign body must be removed from the organism. Suppuration continues as long as a particle of dead bone remains in the wound.

The rifle bullet, usually sterile, is on the contrary tolerated by the organism. If the projectile does not mechanically hinder his movements, the wounded man has the choice of having it extracted or not. This choice is not very much exercised in France, for German bullets are often pulverized into multiple fragments. On the other hand, in Germany, the question has a certain importance, as the French bullet becomes deformed but rarely breaks up. In the hospitals of the Grand Duchy of Baden, the wounded all ask to have the bullets extracted, because the grand duchess has them silver-plated at her expense and returns them to the wounded for watch charms.

Thanks to the X-ray, bullets can be exactly located; ingenious radioraphic tables [fluoroscope? Ed.] serve at the same time as operating tables.

The French sanitary service was surprised, at the beginning of the war, to learn that the Röntgen bulbs used in France were manufactured in Germany. Long months passed before the hospitals could get them.

Penetrating Wounds of the Joints

Wounds of the elbow, the hip, of the knee, complicated joints with few blood vessels, are among the most dangerous. To them are attributable the gravest mistakes of the beginning of the war and many cases of mutilation and death by blood poisoning. It is an accepted principle to-day that every large joint, which has been penetrated by a shell fragment, should be opened widely and drained. If fever persists, the surfaces of the joint must be cut. If this cutting is tardy, it is amputation or death.

Before this war, when an amputation was effected, strips were cut to fold back over and make a good stump. The gravity of the present wounds has obliged surgeons to return to the method of Napoleon's time: cutting the member off and leaving the surface exposed after tying up the blood vessels. Otherwise, there may be an ascending infection of the member.

Tetanus

This grave complication of infected wounds was very frequent during the first months of the war. The microbe lives in the soil as a spore; that explains the great number of tetanus cases in bad weather; the projectiles carry into the wounds the mud on the clothes. The sooner tetanus appears after the wound, the more serious the case; the tardy cases are in general, more favorable. Now a preventive injection of antitetanus serum is given to all the wounded in the trench itself at the "poste de secours." Experience has proved that an injection of serum after the appearance of tetanus is absolutely inefficacious. This preventive treatment has practically suppressed tetanus in France. However, when projectiles are extracted several months after the wound and injection of serum, cases of tetanus have developed. This leads to the necessity of giving a new injection of serum before extracting a projectile from an old wound.

Gaseous Gangrene

Speedy operation of shell fragment wounds has suppressed this terrible complication, to which many wounded succumbed at the beginning of the war, victims of theories of waiting, of lack of means of transportation and of the overcrowding of the hospitals. Wide openings and systematic drainage have abolished the seats of infection away from the air, where the microbes that do not need air to live swarmed and fetid gases developed.

Asphyxiating Gases

This burning of the lungs by chlorine and bromine may be included under war wounds. Daily use is made of the masks saturated with bisulphite of soda which cause the toxic gases to decompose. The soldiers also know that urine has the same result; when lacking bisulphide, they do not fail to use it.

The wounded surprised by asphyxiating gases are treated with subcutaneous injections of oxygen. Fifty liters are currently used; the wounded man becomes a veritable wind bag in appearance.

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The study of the struggle against sickness during this war is a no less absorbing subject. In the great continental wars of the past, the per cent. of deaths by sickness was from 3 to 10 times greater than that by wounds. In the Russo-Japanese war, on the Japanese side, this ratio was reversed. It is nevertheless to the honor of contemporary medicine that no serious epidemic has decimated the armies on the western front. Hygiene has conquered typhus, preventive vac-

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cination has got the best of typhoid fever. Tuberculosis and rheumatism are the most frequent diseases. The great number of cases of madness is not at all astonishing considering the severe strain undergone by the nervous system of the soldier who arrives at the front with all the pathologic heritage of modern man.

The immobility of the western front has permitted wounded soldiers a maximum chance for a cure. On the eastern front, on the other hand, where a war of movement has gone on, the ravages made by typhus have been frightful, and it is sad to think what the fate of the wounded must be, abandoned for lack of doctors, means of transport, hospitals and medicine.

[Bone Graft Surgery—Its Application to Fractures Caused by Modern Projectiles. By E. B. Downer, M.D. *Military Surgeon*, Sept, '17. 3600 words. Illustrated.]

(A technical article, of interest chiefly to medical officers, giving the author's conclusions, after two years' experience during the present war, of the great value of bone grafting in the treatment of fractures. The writer believes that there are really only a few extreme cases where amputation is called for, and that practically all other injured limbs can be saved by proper use of bone transplantation. He does not attempt to go minutely into the details of the repair of fractures, but rather to present a clinical picture as a whole. Several cases are described briefly.)

[War Surgery. A Discussion of the Knowledge Gained in War Surgery. By Professor J. L. Faure. *Revue des Deux Mondes*, Oct 15, '16. 7400 words.]

Before the beginning of the present conflict, the surgery of war was not understood in France. Most surgeons had never seen gas septicaemia, nor purulent infections, and years had often passed without their being able to observe a case of tetanus. They held fond hopes concerning the wounds that would be made by aseptic bullets, whose high temperature, it was believed, would sterilize all germs.

But altho the use of individual first aid packets (carried by the soldiers), and the prompt application of iodine have undoubtedly been of great benefit in preventing infection, still the effect of fragments of shell, carrying as they do all sorts of dirt, had not, by any means, been sufficiently taken into consideration; and the same thing can be said in regard to bullets.

This war has brought about an unheard-of proportion of wounds from fragments of shells, artillery projectiles and hand grenades. Many of these wounds are terrible in their extent and in the immediate disorders produced, but even when they are apparently slight, the tissues are found to be penetrated by all sorts of foreign bodies, particularly of pieces of clothing, which bring about the most rapid and dreadful infections.

The wounded are found in piles, already stupefied by infections, their wounds putrid and full of worms. The fault lies with those who, before the war, were responsible for the organization of the medical service.

The service is now working under satisfactory conditions, which would be better could the evils of paper work and red tape be reduced.

The surgeon's rôle begins with the wound, on the field of battle itself.

Tremendous energy and moral strength are needed in getting the wounded back thru slippery or sticky mud, by way of narrow trenches, under incessant shrapnel fire, and over or thru all sorts of obstacles.

The dressing stations are sometimes distant, and the wounded often die before reaching them.

In a war of maneuver, the dressing station, which must be able to change position and follow the movements of the combatants, is established in a house near the firing line, or behind a bit of wall, or in a ravine sheltered from rifle bullets if not from shell.

In these rudimentary establishments, often under fire, the surgeons perform prodigies. They stop hemorrhages which would else quickly prove fatal, clean wounds, place temporary apparatus which permit the patients to be moved to the nearest field hospital; give injections of ether, caffein, and serums to revive those who are fainting, and injections of morphine to ease those who are suffering.

In the type of warfare now existing, the stationary character of the fronts has permitted the installation, near the firing line, of well-organized dressing stations, which altho under fire are sheltered.

In defiladed shelters dug in hillsides, or deep into the earth, huge, carefully planned caves, are placed litters and beds. Well-lighted operating rooms permit major operations of surgery, such as locating and suturing abdominal wounds; performed a few hours after the injury, soldiers are saved whom operations performed later could not save. These patients, as soon as their condition permits, often the following night, or sometimes several days later, in cases of wounds of the cranium or the abdomen, are removed, when possible in automobiles, to the nearest field hospital station.

Doctors from the rural districts have proved of great service. The country doctor, it might be said, is always at war, against the elements, against fatigue, and all sorts of difficulties. Far from hospitals and from contact with the masters of his profession, he has to do everything, know everything. The good country doctor is a man worthy of admiration.

The field hospital stations where the wounded are taken from the dressing stations are of various types, according to the resources available in the locality. Some are in barns, others in country residences, in large tents, in big hotels. They have been brought to a high state of perfection since the war began. The motor hospitals, devised by Doctor Marcille, have been a great step forward. They permit us to take our operating rooms rapidly to the scene of combat; in them, skillful surgeons perform all the important kinds of modern operations. Radio automobiles also go from hospital to hospital along the front to locate

bone injuries and lesions, fragments of projectiles, etc.

In the field hospitals, therefore, the wounded often receive early their first serious surgical attention, upon which their life or their future welfare may depend. After hemorrhage, which kills quickly, the greatest danger is infection, and against this danger of infection the struggle is incessant.

The most careful cleansing of sores and wounds is the fundamental duty of field-hospital surgeons. In injuries of the head, trepanning is often necessary; in fractures, limbs must often be immobilized in cradles or plaster, or in some of the numerous new contrivances that surgeons have devised. In abdominal wounds also, laparotomy is performed in the field hospitals as soon as possible. Many lives have thus been saved; but for this work skilled surgeons are necessary.

The hospital trains take the wounded to the rear from the field hospitals.

The field hospitals, which from the force of circumstances have become fixed, are surgical centers of the greatest importance. Certain chiefs of these places have for days and nights at a time operated without resting on hundreds of patients, and many wounded owe their lives to these men.

The life or death of most of the wounded depends upon the first attention they receive in the field hospitals.

Most of the serious results are due to infection. Therefore it is the first, thoro, disinfection which must save the wounded from such terrible complications as gas gangrene, prolonged suppuration, etc., which if they do not kill, will involve the loss of limbs or induce an incurable infirmity. It may be said that the fate of the wounded rests upon the first operation, the first cleansing of the wound; no attention, no care, can be too great in these preliminaries.

It is often very difficult to give this minute and detailed care, and for this work born surgeons are needed. The surgeon must, in working on wounds in vital centers, know how to cut the flesh, how to work with assurance in the regions of the vessels and organs that must be treated with respect. The work can be done only by men with a perfect knowledge of anatomy and with the experience that comes from daily practice.

The disinfection of wounds received in battle can not be carried too far.

In the field hospitals injections of tetanus serum are given to almost all the wounded. The serum has proved its value; tetanus is to-day very rare. There is no doubt that its almost complete disappearance is due to the regular injection of the serum in the field hospitals.

In this great fight against infection many young surgeons have performed a wonderful work, triumphing over red tape, out of date methods, lack of support and stupidity on the part of certain superiors unworthy of the high positions they hold.

Naturally all surgeons are not equally capable. As in all other branches of human activity, men of talent are rare, and it is impossible to have good surgeons everywhere. The medical service has appointed district or sector surgeons, who by unceasing and sometimes excessive work, have been able to operate themselves or to direct treatment in all grave cases in their sectors. The services of these men are inestimable.

Surgery at the base hospitals is quite different from the every-day sort. There is the surgery of infected fractures, of sloughing sores and foreign bodies left unextracted, of complications of all kinds due to nerve injuries (so common now); of mutilations of all kinds, particularly those of the face, often necessitating multiple auto-plastic operations, in order that some resemblance to a human being may be re-established; of fistulas of the bony structures, which reappear sometimes interminably, all testing the courage of the wounded and the patience of the surgeon.

Women have been of untold service. Thousands of them have worked with us night and day. They can not be praised too much, and it is hard to imagine what we could have done without their aid.

To-day the wounded are sent to the base hospitals in infinitely better condition than formerly. Their wounds have been better treated, explored, drained and cleaned. There is a better application of the complicated apparatus of all kinds, often of types unknown before the war, but now in general use.

The methods of evacuation have been slowly transformed: the use of automobiles has grown to enormous proportions. Numerous hospital trains have been fitted up with all kinds of needful resources, and run with speed and regularity.

The system of train despatching and railway service in general has been wonderfully improved.

Surgical equipments have been perfected and developed in many ways. Money privately contributed both at home and abroad has largely assisted in making possible these better conditions.

[Carrel on the Treatment of War Wounds. From *The Military Surgeon*, Apr, '17. 3000 words.]

(What follows is a summary of an informal address made by Doctor Carrel at the Army Medical School.)

I served for twenty-nine months with the French army at a base hospital about two or three days distant from the front and afterward in a research hospital, organized by the French War Department, about seven or eight miles from the German trenches. I saw almost every kind of wound, and it was most interesting to follow the evolution of the treatment begun. At the beginning of the war we had the idea that all gunshot wounds were sterile. The result of this was that the wounded, with first-aid dressings only, were sent directly from the battlefields to the base hospitals. It was soon found that some bullet wounds were sterile, but that all cases of shell wounds were more or less severely infected. During the last months of 1914 we tried all kinds of treatment—alcohol, phenol, iodine, hydrogen peroxide, iodoform, etc. But no real progress was made, and we did not succeed in stopping suppuration. In November and December of 1914, I visited many of the field and base hospitals in order to learn everything I could about infection. One hospital was only about nine miles from the German

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trenches in a very dangerous district. It was hazardous to get the wounded to it, and the result was that often ten or twelve hours passed between the time of the wounding and the arrival of the patient. Every wound, of course, was infected. The surgeon told me on my arrival that he had taken care lately of a hundred cases of gas infection, and that the death rate had been more than fifty per cent. The results in the treatment of fractures of the thigh in the same hospital at that time were disastrous. They were generally followed by amputation or death or both. In many other hospitals the results were not so bad, but every wound was infected. Of one hundred amputations, seventy or eighty were performed on account of infection. These conditions were primarily due to the fact that the hospitals were inadequately organized, the equipment insufficient, and that in many places the surgical heads were not surgeons at all, but even dentists, obstretricians, and sometimes old family physicians. But the main cause of the high death rate was that surgeons failed to realize the necessity of widely opening every wound as soon as possible and removing the foreign substances it contained if gaseous and other infections were to be prevented. Colonel Uffoltz, medical director of the army corps, understood as early as May, 1915, that the future of the wounded depended entirely on rapid transportation to the hospital where the wound could be widely opened under aseptic conditions. Few men understood this principle, and it took a long time before it was finally admitted that time is a very important factor in infection, and that when a wound is widely opened the life of the patient is almost safe.

To provide for rapid transportation, a large number of automobiles has been acquired. Since wounds have to be opened as soon as possible, it follows that field hospitals must be situated as close as possible to the trenches, so a number of the hospitals are now only four to ten miles from the fighting lines. These hospitals have to be very large, because of the likelihood of the great number of wounded being brought in constantly, and because after the operation it is dangerous to send at once the patient to another and more removed hospital. As the war progressed, it became more and more apparent that it was necessary to have much larger field hospitals. Accordingly, large hospital units of three thousand beds at least are used in the French army. These hospitals are made of portable houses, and not of tents. They should be as comfortable as possible, and the money spent on them is a very good investment, because operations performed under good conditions save the lives of many men, and a man has a value of more than six thousand dollars. Smaller hospitals of twenty or fifty beds for adominal operations have been established at several points a few hundred yards from the lines. They are generally underground.

There was practically no equipment for operating rooms at the beginning of the war. As soon as the disastrous result of this state of affairs was recognized, sterilizers and other apparatus were provided as rapidly as possible. Under the direction of the medical department of the war office, a special outfit for operating work was devised called the Surgical Automobile Field Hospital. It is composed of the portable operating room as well as dressing room, sterilization room, X-ray room. A steam boiler provides steam for the large sterilizer and other apparatus and also power for electric light. The entire outfit is carried on four automobile trucks. In the larger field hospitals of over three thousand beds, three or four of these operating units are used. The general organization for the care of the wounded near the lines has made great advance. All wounded can be operated upon within the first twenty-four hours, except during big attacks. The best practical results have been obtained in flesh wounds and fractures. The number of cases of gas infection has greatly diminished, less septicemia is observed and much less amputation is necessary. Over 90 per cent. of the patients coming in from the hospitals are infected, but the infection is now less dangerous and the death rate has been certainly decreased.

The clinical researches made at Compiègne have shown that by using proper technique wounded infection can be almost entirely controlled, and that pus can be completely eliminated from the hospitals. I observed at the beginning of the war that the main cause of mortality among the wounded was infection, and that all our efforts should be directed toward its suppression. Dakin found a number of substances which, being but slightly caustic for the tissues, can be used in a wound in a sufficiently strong concentration and during the time necessary to bring about sterilization. The substance we used is sodium hypochlorite without alkali in a concentration of .05 per cent. This substance is known as Dakin's Solution and the method of its application is not complicated, but it is impossible to learn the procedure in a few hours. About three weeks are required by an experienced surgeon to learn how to sterilize a wound. Carefully applied, sterilization results rapidly. If the patient be treated when the wound has begun to suppurate, pus stops rapidly, in two to four days generally, the sterilization can be obtained, and the wound ultimately sutured.

The saving of time brought about by complete sterilization is striking. Of 136 wounds treated in my hospitals in December, 1915, 121 were closed before the 12th day. As this closing would, by ordinary methods, have taken from 30 to 60 or even 100 days, it is easy to understand the saving of men which was effected. When we consider that statistics, based upon more than 50,000 amputations, show that 70 per cent. of these are due to infection, we can readily see that one-half of the amputations might be avoided by proper treatment.

[Observations by a Junior Surgeon of the John B. Murphy Hospital Unit, Serving with the British Expeditionary Force, France. By Asst. Surgeon R. B. Acker, U.S.P.H.S. *Military Surgeon,* Sept, '17. 9400 words. 34 illustrations.]

(A valuable article giving in considerable detail the methods of treatment which have been found to be

most efficacious as a result of the experience of the British Medical Corps. A number of actual cases are cited. The article is illustrated by many illuminative photographs. It is of especial interest to medical officers only.)

[War Surgery. By Col. T. H. Goodwin, D.S.O., R.A.M.C. *Military Surgeon*, Sept, '17. 6500 words.]

It had been hoped for many years past that, with the improvement of antiseptic methods and better general treatment for wounds, sepsis in future wars would not be a serious factor. The result has not by any means justified these hopes. The cause is probably the extremely polluted condition of the soil in the fighting area. The ground thruout Belgium and northern France has been extensively cultivated and heavily manured for many years and is consequently rich in organisms of all sorts. As the air is usually heavily laden with dust from shell fire, a wound is almost invariably infected as soon as inflicted. Another cause for the frequent occurrence of sepsis is severe damage done to the tissues by the modern high velocity missile. These destroyed and devitalized tissues form a very favorable nidus for the growth of any organisms which gain access to the wound.

(The author then enters into a technical discussion of some of the symptoms and methods of treatment of surgical cases in the present war. The matter is mostly in the form of greatly condensed notes which are not susceptible of further digesting. The article is chiefly of interest to medical officers who should read the original to obtain any benefit from it.)

SURVEYING

See also

MAPS AND MAPPING
SKETCHING

SWEDEN

—Army—Artillery

See

FIELD ARTILLERY—SWEDEN

—Food and Commodity Prices and Supply

[The Ability of Sweden to Sustain Herself from Her Own Resources, During the Present Crisis. By S. Klingspor. *Svensk Intendentur Tidskrift*, Nos. 7 and 8, '17. 3000 words.]

The situation of Sweden with respect to self-sustenance may now—May, 1917—be said to be similar to that of countries actually at war, as it only differs in name from a real state of blockade. The policy of starving out the Central Powers affects us almost as much as them since, in order to be effective, a chain of exclusion has to be formed entirely around the Central Powers and the last link in this chain is Sweden, which, from its position, is subject to pressure from three directions: from England, Russia and Germany. The pressure from the west, or England, is felt most, as it is from that side, that is from America, that most of the essential articles are imported. The ability of this country to live on its own resources under such conditions is therefore a measure of its ability to remain neutral, and of its power to enforce such neutrality. To live on one's own resources may be taken, in a restricted sense, to mean to possess or be able to produce in sufficient quantities provisions necessary to sustain human life. In a more comprehensive sense it includes, besides provisions, industrial products of all kinds, raw material and the machinery for making it up; also the facility for making these provisions, etc., accessible to people in different parts of the country at a reasonable price.

The problem of supplying a sufficient amount of suitable provisions is by far the most important, since the amount of land under cultivation in Sweden is only about 12 per cent of the total land area. Of the cultivated land about 60 per cent is in Gothland, 25 per cent in Sweden proper, and 15 per cent in Northland. Skane alone produces 50 per cent of the wheat raised in Sweden, while the four northern provinces cannot produce wheat, beans or sugar beets.

Altho only about 12 per cent of the total land area is used for agriculture, yet this and fishing occupied 72 per cent of the population in 1870. A smaller proportion of the inhabitants have, however, in later years been occupied in agriculture, and this is due in great measure to the change in what is produced. Under normal conditions it has lately been found that breadstuffs could be imported more cheaply than they could be raised, hence more attention has been paid to raising cattle, dairy products and hogs, which were found more remunerative. This necessitated the importation of flour, fodder and fattening material. Since the outbreak of the war such importation has become very difficult, and now has almost stopped.

Under normal conditions the importation of rye is about 14 per cent of the total consumption, that of wheat about 48 per cent—and of bread producers (wheat and rye) the extra amount needed is 26 per cent of the total consumption. If importation ceases we then have, from what we produce, 2/3 of the normal need of bread stuff. Normally the consumption of bread stuff was net 301 gr. rye and 189 gr. wheat per day for each person, of which the imported part was 47 gr. rye and 96 gr. wheat. It must, however, be taken into account that barley is cultivated in considerable quantities in the northern part of Sweden. This is also used as bread stuff, so that by taking this into account what is lacking in wheat and rye can be made up by using barley.

With respect to the production of oats, mixed grain, hay and straw, as well as potatoes, we are not in need of import under normal conditions. The yearly yield of oats and mixed grain is, on the average, greater than the total of all the bread grains, which shows the dominating position of the dairy production. The gross import of potatoes was about 1.3 per cent of the total consumption, while the distillation of whiskey took about 7.1 per cent, so that a reduction of the latter would obviate importing any potatoes.

The increased attention paid to raising cattle and hogs and to dairy products has necessitated a greater

SWEDEN—Continued

and greater importation of fattening foods, such as Indian corn, linseed cake and feed for cattle. This has reached as high as 61 per cent of the total consumption.

Before the war large quantities of the raw material for artificial fertilizers, such as Chili saltpeter, potash and raw phosphates were imported. It has been found however that there exist great natural resources of lime, nitrogen, potash and phosphate, so that there will be no need of importing these necessary fertilizer ingredients. As to the colonial products these, of course, have to be imported except sugar, of which practically all that is needed can be produced at home from the sugar beet. Coffee and tobacco are the principal articles that cannot be produced at home and so must be imported, but these are considered by some as luxuries and not necessities:

One thing is noted, and that is that there is a lack of a sufficient number of cold storage houses for keeping meats, and storehouses for grain (grain elevators), since it has heretofore not been found necessary to store either meats or grain for long periods, or in large quantities.

Steps have lately been taken to regulate the consumption of food and as much as possible prices of the same.

It was decided to put the people on an allowance the first of this year. The amount of flour that each person was to be allowed daily was about .55 lb. (equal to about 5/7 lb. bread). This allowance was increased somewhat for men engaged in hard work, and for the soldiers. It was afterwards found that the amount of grain on hand, together with what they had been able to import was not sufficient for this allowance and it had to be reduced to .44 lb. grain for each person per day. Many more extra allowance tickets had to be issued than was expected, and to fill the need of grain a portion of the amount set aside for seed had to be used for bread. Even then the amount on hand would scarcely last until Sept 25, 1917, when the grain raised this year will be ready.

It was proposed to raise more barley, as this is the best yielding and surest grain for this country, and is very valuable for food. It was further decided to have the Government take complete control of the disposal of the entire yield of grain. Of the vegetable foods there seems to be less dearth and indications are that if there is a normal yield there will be enough raised for the country's needs.

At the beginning of the war there was a surplus of about 50,000 tons of sugar, owing to overproduction, and of this amount only about 15,000 tons was exported to Norway, but the consumption of sugar has greatly increased, so that it has necessitated the rationing of this also, each individual to be allowed 1 kg. (about 2.2 lbs.) a month.

The amount of potatoes raised in 1916 was less than the normal and, as an indication of the scarcity of this necessary vegetable, it is noted that the prices paid in January, 1917, were 1.6 of what they were in January, 1916—that is over 50 per cent more.

There is also a scarcity of oats owing to the fact that not only has more been needed as food for cattle and horses, but a great deal has been used to make meal for human consumption.

As for meat and pork, these can readily be subjected to rationing, but milk and butter are more difficult. The sale of eggs has also been taken charge of by the Government, so that they can be obtained at reasonable prices.

(The author thinks that by a careful regulation of the consumption of the necessary articles of food—especially bread—using for this purpose rye, barley and oats in addition to wheat, the people can live off what the country itself can produce. A great deal, however, will depend on how this year's crops turn out. If they are a failure great distress will no doubt result, if the war continues and the importation, of bread stuffs is excluded.)

SWIMMING

—Instruction and Training

[Swimming. By A. D. T. *Voenny Sbornik,* June, '16. 1500 words.]

(This is an illustrated account of how to teach swimming. Several different styles of swimming are described, all of which are well known in this country.)

SWITZERLAND

—Army

[A Few Words About Our Active Service. By Capt. F. C. Hoguer. *Rev. Mil. Suisse,* Dec, '16. 1100 words.]

Our élite troops are going to be mobilized for the fourth time since 1914. They have had, most of them, three periods of service of a total of 13 months.

The hardship, from an economic point of view, imposed on our soldiers increases their cares and uneasiness with each new call to the colors. Therefore, the duty of the leaders to sustain the morale of the troops is becoming more difficult. It should, nevertheless, be the first of their duties and their constant preoccupation.

My experience as an organization commander leads me to believe that the service should be arranged so that all the men, especially of the infantry, should take an active part in the police of our frontiers.

It may be said in a general way that our men are well enough grounded in individual instruction, in fencing and in gymnastics, and that when they are called to the colors again, a little time only is required to put them back in form. Maneuvers, especially with the combined arms, which always interest the troops, are becoming almost impossible on account of the crops.

It is quite a problem then to keep up the interest. There will be target practice, and practice marches, then lectures, readings and singing. But the interest in lectures or reading flags, and singing is utterly dependent on good morale; it can hardly be successfully conducted "by order."

Question the men about the best memories of the mobilization, and they will tell you of the days spent in the first line stations, even in those far from the war zone. In fact, the best tonic for the soldier is to be on sentry duty on the frontier, to do patrolling along the frontier at any hour and in all weathers, to hear the sound of the guns, even though it be distant.

That is the service that strengthens his sense of duty, of discipline and of obedience and that reminds him, more than the best of theories, of the necessities of the present hour.

Certainly the leader's best memory is of the periods when the company performed alone the service of a frontier sector, or did guard a section, or again when two companies did the same service alternately with two sections. This latter method is the best and good results are obtained if the rotation of guard duty covers periods of eight days. The company commander has his whole unit at his disposal for the first two days; the two following days, he has the first and second sections only, the other two being on guard; on the fifth and sixth days, he will again have his whole company under his orders; and the seventh and eight days sections three and four only.

The days when the company is split up can be devoted to detail work, the days when the company is united to target practice, practice marches, etc.

This method appears to correspond to the necessities of our own security and of our international duty as long as the general situation is unchanged and our relations with our neighbors remain cordial. One advantage is that in the battalion sector, for instance, the major would have a reserve of three companies against any contingency. Altho we recognize the disadvantages of scattering troops in this manner, we believe that they are offset by the improved morale that would result in keeping them all occupied at something that holds their interest.

[Organization and Training of the Swiss Army. By Theodore A. Christen (former officer of the Swiss Army and former member Ohio National Guard). *National Service*, May, '17. 5000 words.]

Swiss Mobilization, 1914

"General warning" was issued July 31, 1914, which set in motion certain of the preparations for mobilization, and the *landsturm* troops were called out for general guard duty so as to completely release the first and second line (*élite* and *landwehr*) troops.

On Aug 1 mobilization was proclaimed for 9 a. m., Aug 3. All men from 20 to 48 who had had military training were called to the colors. The government assumed control of the railroads and the mobilization warning was rung by the church bells. On Aug 2 the railroads were still open to civilian travel and all soldiers and officers returned to their homes, settled their affairs as best they could, prepared the arms and equipment which each Swiss soldier keeps at home, and the assembly places were made ready.

On Monday, Aug 3, everybody who had had military training went to his post. Not only were the units trained, equipped, and officered, but they were complete in every respect, including 170,000 rounds of ammunition for each battalion.

On Aug 4 transportation and concentration continued. Neutrality was declared, and unlimited credit voted, subject to accounting after the war. Gen. Wille and the Chief of the General Staff took over the command of the army.

Preparations to put the frontier and country in a state of defense were begun on Aug 4 and continued thereafter. The border has been closely guarded. Neutrality, strongly armed and guarded, has commanded respect.

The mobilization was a complete success. In 48 hours the full strength of the nation (300,000 men or 9 per cent of the population) was assembled in readiness for immediate use.

History and Traditions of the Swiss Military Institution

Universal service has been the root of the Swiss military system since the early times, but the early system had the defect of being cantonal and hence lacking in unity of action. Disaster resulted in the French invasion of 1798, and Switzerland paid a heavy price. Reforms in the military system by laws of 1817, 1850, 1874, and 1907 resulted in practical cessation of cantonal control.

The army system evolved embodies certain principles briefly as follows:

(1). A large army thru universal obligatory service.
(2). Speedy mobilization in complete readiness.
(3). Thoro training in as short a time as possible.
(4). Mobilization of resources to supplement the work of the army.

There is no standing army and the time of training is short. Nearly all the officers are non-professional and return to civil occupations between periods of service. Officers are obliged to accept promotion. The army administration alone is permanent and professional.

The recruit enrolls at 19, and is given a thoro mental and physical examination, accompanied by physical tests. He may be declared fit for service, ordered to appear again for examination at a later date, fit only for auxiliary services, or he may be declared unfit for any service. Records for 1910 showed 63.4 per cent fit at once; 11.4 per cent remanded for further examination; 17.9 fit for auxiliary service; and 7.4 per cent totally unfit.

The attitude toward military service is such that all look forward eagerly to it and dread being rejected. Assignments are made according to special fitness. The training is thoro and energetic, and accomplishes maximum results in minimum time. No distinctions are made because of ancestry or social standing. The service is democratic, and military training has been the making of many men. Shooting is an important feature of the training.

Repeat Service and Maneuvers

The first line recruits (20 to 27 years) receive 65 days initial training and 11 days each year thereafter,

SWITZERLAND—Continued

or a total of 142 days. The repeat service (28 to 32 years) alternates between training in small units and training in large units (maneuvers). The maneuvers are very realistic and a subject of intense public interest and extensive newspaper comment. The time for the maneuvers is selected so as to interfere as little as possible with the ordinary civil business. The maneuvers occur at different times in different localities. Families in need may be assisted during maneuvers without stigma, and every soldier is insured against accident and disease.

There is a single repeat service or maneuver in the *landwehr* (32 to 40 years).

All officers of the Swiss army are procured thru selective promotion from the ranks, and each officer must pass thru every grade. Promising recruits are asked to "aspire" to become sub-officers and officers. Service as an officer requires additional time and is recognized as a sacrifice, and no one is asked to bear this burden unless able to do so. It is almost obligatory upon the educated and professional classes to become officers, but fitness is the first consideration. All tests are practical, and there are no examinations.

The lieutenant gets a total of 241 days of instruction before assignment to troops. He must serve as a 2nd lieutenant four years and receive a special 18-day shooting course before he may receive the grade of 1st lieutenant, and another four years before he can become a captain. Further promotion is by special fitness, and in each grade the officer must lead his unit in at least four repeat services or maneuvers. He may during this time be required to attend the central school and General Staff courses, or he may even be attached to the General Staff. Between services he always returns to civil occupations. Only in the highest grades is military service continuous. There were 189 permanent officers in the Swiss army in 1915.

"Weeding out" occurs at all stages, and thus is formed a reserve in all grades. Every one must start in the ranks. If service as an officer carries no serious hardship, those capable must advance through all the different grades. The privilege and the responsibility of military service belong to all without distinction on account of wealth, social standing, or any other consideration.

—History

[The Share of French Switzerland in the Military History of Switzerland. By V. *Rev. Mil. Suisse,* Dec, '16. 7500 words.]

(An historical article.)

[The Share of French Switzerland in the Military History of Switzerland. By V. *Rev. Mil. Suisse,* Jan, '17. 5300 words.]

(An historical article.)

SWORD

See also

INFANTRY—ARMS

TACTICAL RIDES

See

CAVALRY—INSTRUCTION AND TRAINING—TACTICAL RIDES

TACTICS

See also

AERONAUTICS—TACTICS
ATTACK
CAVALRY—TACTICS
ENTRENCHMENTS—TACTICS
FIELD ARTILLERY—TACTICS
INFANTRY—TACTICS—ATTACK
INITIATIVE
MACHINE GUNS—TACTICS
MARCHES AND MARCHING
MOBILIZATION
MOUNTAIN WARFARE
NIGHT OPERATIONS
RAIDS—TRENCH
STRATEGY

[Advice About Tactics. (Taken from the Work "Essai sur la Tactique.") By Major Quiroga. *Revista Militar,* Sept, '16. 2400 words.]

It is a good thing to study the regulations, to know something of modern campaigns, to read the articles on tactics which appear in the military reviews, etc.; but these measures in themselves are insufficient. There must be acquired a rapid and precise judgment, the ability to distinguish the true from the false or the necessary from the unnecessary, the faculty of separating that which leads to the end sought from that which does not; these are the qualities to be developed by military study. Study must be methodical in order to get results. Method is the road which the man of experience and common sense follows to reach a given objective. Care must be taken that method be not displaced by routine.

Campaigns should be studied carefully but it is useless to try to memorize such details as names and dates. It is the judgment not the memory that is to be developed.

Independent study is necessary to enable one to acquire that clearness of mind and spirit of initiative indispensable to a commander in war. Company commanders must not allow administrative details to interfere with tactical instruction; on the other hand, they must take time properly to prepare themselves to lead their units in combat. Initiative, common sense and the will to accomplish results must be fostered and developed in subordinates.

Methods of combat are variable but the fundamental principle of combat does not change. This is to close with the enemy at any cost and to destroy him. Victory rests with that army which has the greatest number of officers and men determined to conquer or die.

[Modern Battle Tactics. By Capt. Ian Hay Beith. *National Service,* June, '17. 6350 words.]

The present war is a war of machinery, certain new weapons of offense and defense have been introduced, and modern battle action has been accordingly modified.

The greatest innovation is the employment of huge masses of troops, made possible by improved methods of preserving foods, and by improved methods of transportation,—notably the automobile,— and by improved methods of sanitation. Altho in former wars the deaths from disease far outnumbered the deaths from wounds, pestilence and disease have practically ceased to exist in the enormous armies now facing each other.

Another factor is the employment of artillery on an immense scale, made possible by the use of the airplane for observation of fire. In fact the whole fabric of modern warfare hinges on the airplane. Nothing is safe from its view, and trench warfare is the direct result of the effectiveness of airplane reconnaissance. An airplane can operate offensively by dropping bombs, but the real effect of this method of warfare is small. The most important use of the airplane is in the control of the fire of heavy field artillery. The airplane has made it worth while to construct heavy artillery, because only by its use can long-ranged artillery fire be made effective. The use of great masses of troops, the airplane, and heavy artillery have operated to introduce trench warfare and have practically abolished strategy. It is interesting to speculate as to what Napoleon would have done against the impregnable trench line running from the North Sea to the Alps.

Mastery in the air may have a deciding influence on the result of the war. The effort in this direction is indicated by the fact that there are more men now in the Royal Flying Corps than in the whole British army before the war began.

The old weapon was a magazine rifle with a bayonet. Trench warfare has served to introduce or revive the use of the machine gun, the bomb or hand grenade, the trench mortar, gas and flame projectors, and defensive armor such as the steel helmet, etc.

Machine Guns. The machine gun was in use before this war, but its use has been developed to such an extent as to make it count practically as a new weapon. Its importance cannot be overestimated. The Germans appreciated its importance and had about 50,000 of them when the war began. The British had two machine guns per infantry battalion, or about 300 altogether. Now the British have one machine gun to every 70 or 80 men fighting.

The machine gun has an enormously high firing power combined with small operating personnel. One machine gun properly handled is considered to be equal to 100 men with rifles, and only two men are required to handle it. Besides, it is much easier to find or construct cover for a machine gun than for its infantry equivalent. If it is knocked out by artillery, it is easily replaced.

There must be made a careful distinction between the machine gun and the automatic rifle. The British army uses the Vickers machine gun (gun 45 lbs., and tripod 48 lbs.), and the Lewis gun (26 lbs. weight). The typical machine gun has two invaluable characteristics. It fires from a fixed mount and can be used effectively at night by previously setting on a target, and the water cooling enables it to be fired continuously.

The Lewis gun cannot be fired effectively at night but must have a visible target on which to aim, and it cannot be fired absolutely continuously. But it can be carried wherever infantry can go as fast as infantry can go, and it can be carried on the shoulder so that it is difficult for the enemy to locate it when carried into action. The difficulty of detecting a Lewis gun when carried among other rifles was demonstrated by a test at the (British) machine gun training school.

The machine guns (heavy) are usually put under the brigade commander in a machine gun company of sixteen guns under the command of an officer. There are eight subalterns with the company so that it can be split up into sections of two guns for action. A machine gun company requires about 16 wagons and 60 horses for transportation of ammunition.

The machine gun is a brigade weapon, and is used by the brigadier to augment his fire wherever desired, usually keeping at least four guns under his command as a mobile reserve.

The Lewis gun, or automatic rifle, is a purely regimental weapon. So many are allotted to each battalion and they are controlled by the battalion commander thru the gun commander. The Lewis guns go everywhere the infantry goes, and form a powerful supplement to infantry fire, especially important in recent operations.

Hand Grenades. Hand grenades are indispensable in trench fighting, because they can be used to clear out a traversed trench where rifle and bayonet are powerless. The earlier grenades were improvised and were exploded by an ordinary fuse lighted before throwing. They were difficult or impossible to light in the rain, and the time of burning was uncertain. With a ten-second fuse, if thrown too soon the grenade could be thrown back by the enemy, and if held too long the result was disastrous. Now a type is used in which a lever, held firmly down until the grenade is thrown, flies up and lights the fuse when released in throwing, and the grenade expiodes five seconds later. An impact fuse is also used, but great care is necessary not to hit the side of the trench in throwing, or to allow the streamers, attached to cause it to fly head on, to catch in the equipment, either of which results disastrously.

Trench Mortars. The trench mortar has been greatly developed and is used as a very effective supplement to artillery fire. The trench mortar is simple and cheap, and can fire a sixty pound shell two or three hundred yards. It is hard to knock out because its almost vertical fire permits it to be sunk in deep pits. Some later types fire bombs at the rate of about 20 per minute. The Gemans use very large trench mortars. The weakness of the trench mortar lies in the fact that its projectile can be seen coming and thus sometimes evaded.

Gas and Flame Projectors. Chlorine gas is usually used. The results of the first use of it were terrible. It is more or less a back number because of the general use of gas masks which serve to make gas attacks more annoying now than dangerous. Another difficulty

TACTICS—Continued

is that to deliver a gas attack there must be a wind of three to four miles an hour blowing directly toward the enemy, and it may be necessary to wait a week for this condition. It is bad for the morale of an attacking force to hang up for a week keyed up for an attack.

The flame projectors are used by two men, one of whom carries the reservoir and generator and the other a hose pipe. The scope is limited. The extreme range is only 25 to 30 yards and a grenade is effective beyond that range and can usually stop the operation of a flame projector.

Defensive Armor. The steel helmet is almost universally used, but it was very unpopular when first introduced. It is heavy and ugly, but it is impervious to shrapnel bullets, shell splinters, and to rifle bullets except at close range, and in the aggregate saves many wounds.

The greatest use of defensive armor is the tank. Tanks were very effectively used in the battle of the Somme. They are about the length of a Pullman car, and are able to travel over almost any ground. The only thing that stops them is heavy mud.

Modern Battle Tactics. A modern attack must cover a wide front—ten to fifteen miles—and be supported by other attacks on contiguous portions of the line so as to conceal the true objective of the attack. Three points must be kept in mind:

(1) The necessity of a limited objective. At first, all units were ordered to advance as far as possible, with resulting irregularities according to resistance encountered. The operation of straightening and readjusting the line was difficult and costly. Now the system is to designate a line as the objective. All units reaching the line remain there until the whole line is secured, and no unit goes further forward until ordered to do so. This insures the occupation and consolidation of a tenable line at each stage of the action.

(2) The whole battle operation is founded upon what the artillery does. The artillery sets the pace and the infantry follows.

(3) Elaborate preparations are necessary to keep the roads behind the battle lines clear. Tremendous quantities of ammunition are required for machine guns and artillery, with corresponding amount of transport. Perhaps reinforcements must pass thru this mass of transport.

So much for the higher command. The company commander has to know thoroly the ground over which he is going to operate. A detailed map is furnished him for this purpose. He must study the general operations order and pick out every paragraph that concerns himself and then write his own order. The question of written orders is important as a means of fixing responsibility for failure. All sorts of preliminaries must be carried out. Before the battle of Loos a stretcher was carried clear thru the trench dug for the evacuation of the wounded to test whether it could get around all corners easily.

The attack takes place usually at dawn after the preliminary artillery bombardment sometimes lasting for weeks. Suddenly the artillery fire ceases at an appointed hour, sights and fuses are adjusted to lift the fire on to the next line, and the infantry goes over the parapet. The great and immediate question is, has the wire been cut? If not, there is trouble. The machine guns are emplaced to play on the ground in front of the wire. The French have extended their wiring system so as to provide additions to their wire especially placed to bring the enemy in line for machine gun execution. If the wire has been cut, the remains taken and the attack advances along the communication of the firing trench and the few men left in them are trenches, using bombs and guns to dispose of any enemies, until the first line or objective is reached, and there the attack halts. Then materials are brought up to enable the ground to be consolidated—trenches reversed, barbed wire placed, machine guns installed, telephone communication restored, food, water, bombs and ammunition brought up, etc.—all the many items necessary to secure possession of the new ground and enable it to be defended.

Perhaps an advance is made to the second and third lines, but at some point almost certainly will come an intensive bombardment and an enemy counterattack. The Germans are extremely capable in delivering these attacks. In the early days, the British attacks frequently lost some of the ground gained to these counterattacks. Since the battle of the Somme, altho ground is more difficult to gain, the preponderance of the British artillery and machine gun fire, together with superior airplane observation, has been such that ground once captured has in practically every case been held.

At nightfall the attacking force, unless the casualties have been very light, is relieved by fresh troops, and it goes back to a well earned rest.

Germany

[Germany. Her Invincible Infantry. Reprint from *El Diario Alemán. Memorial de Caballería,* Jan, '17. 400 words.]

German officers possess the art of concealing an army. The fundamental principle of infantry tactics appears to be to see without being seen. So admirably does the German uniform blend with the surroundings and so skilfully do the troops conceal their work that combat with this infantry is like fighting with so many spectres.

—Artillery

See also
ARTILLERY—TACTICS
COAST ARTILLERY—TACTICS
FIELD ARTILLERY—TACTICS

—Cavalry

See
CAVALRY—ORGANIZATION

—Field Service—Attack

See
ATTACK
INFANTRY—TACTICS—ATTACK

—Instruction and Training

[Bibliography. *El Libro de Comando. Revista Militar,* Oct, '16. 310 words.]

This is a review of the book by Lieut.-Col. Oro and Argañaray for use of army officers in connection with tactical exercises for Infantry and Field Service Regulations. The work is an adaptation for the Argentina service of the manual by Captain Siwinna of the German Army.

—Instruction and Training—Tactical Problems

See also

CAVALRY—INSTRUCTION AND TRAINING—TACTICAL RIDES

[The Tactical Measuring Rod. By Major John McA. Palmer, U. S. A. *National Service,* Apr, '17. 4450 words.]

(Editorial Note: This article discusses the methods of training and selection of German officers in peace times for troop leading responsibility in war. It was written prior to the present war in explanation of Prussia's military successes against Austria and France in 1866 and 1870, yet throws much light on Germany's present military efficiency and explains the secret of her resistance against the superior resources of her enemies.)

When war broke out between Austria and Prussia in 1866, the Austrian Army was composed of veterans and commanded by generals developed in the school of actual war. The Prussian Army, soldiers and leaders, was without war experience. Each belligerent having equal military resources, the results were astonishing, as in six weeks time the veteran army suffered the most decisive defeat of modern times.

The victory of the Prussians was attributed to the needle gun, but in fact lay in the system of training perfected by the German General Staff under von Moltke.

Likewise the French had a veteran army trained in the Crimea, Italy and Africa. They scorned von Moltke and his military pedants as they felt that war was an art and not a science, that peace training was valueless in comparison with the only actual training, that of war.

But the war of 1870 was even more decisive than that of 1866. The German leaders everywhere showed superior leadership, and within seven weeks the main campaign was ended. Von Moltke had attained the Napoleonic ideal—an army in which each individual was trained to do the right thing under any circumstances without waiting for orders.

These Prussian victories were the victories of peace-trained armies over the veterans of wars. Von Moltke's system of training vindicated the superiority of professional practice over theoretical study, and demonstrated the inferiority, in many respects, of professional practice in peace to actual practice in war.

This new system was developed by von Moltke and his predecessors with the idea of securing the actual practice of the profession of arms in peace. Each tactical commander was a practical soldier of tried abilities before the war began. In the sudden crises of the campaign they were enabled by this system of instruction to carry out the supreme commander's will without awaiting orders. The germ of the system perfected by von Moltke seems to be found in an exercise invented by Frederick the Great to develop his own tactical judgment. In viewing any bit of scenery he would question himself: what would a man do if confronted in such a place with a certain tactical problem? The idea being to make a decision and issue an order.

While valuable as a means of self-culture, this system is even more valuable in enabling a competent tactical instructor to train other officers. The instructor gives the situation assumed and requires the student to make the decision and issue the orders. The orders being issued, the instructor is able to apply his tactical knowledge to the criticism. He may bring in developments of the situation to point out faults in the student's disposition of his troops, and then let him endeavor to overcome them. Such an exercise is positive professional practice and the student actually undergoes a war test.

Besides being valuable as a means of self-culture, the system has another value. In a class of young officers, educated soldiers, familiar with theoretical tactics and military history undergoing this training, all will, at first, give more or less faulty evolutions. Gradually they will develop facility in estimating situations and in the issuing of orders. Then they will begin to form themselves into three classes. One group will show the rare gift of tactical judgment and decision of character essential to become successful troop leaders. They will possess the rare eye for ground so indispensable in the general staff officer of higher commands. The second group will be those of normal tactical ability, and with more experience will become effective leaders of the smaller commands, and may grow into equally effective leaders of brigades and divisions. The third group will comprise all those of deficient tactical ability, and will serve to differentiate another class of equally able men for a different class of military work, such as supply officers, adjutants-general, etc.

The simple terrain problems outlined above are not all of the Prussian system. These are preceded by exercises known as map problems. Tho the methods are similar, these are more deliberate, allowing a more careful consideration of all the details involved, and serve to instill a systematic method of estimating military situations. The deliberation of the map problem being more are less artificial, these are supplemented by another exercise—the war game or map maneuver. Here opposing forces are represented by suitable colored markers. These are moved by the instructor in accordance with the orders of their respective commanders. The information of their opponent's force is such only as they would learn by their employment of their troops. When the situation is fully developed, the instructor places all the markers on the map and for the first time they see the whole situation. This exercise develops initiative and decision and gives practice in command.

In order to correct the artificial medium of the map, similar exercises are given on the ground, the terrain

TACTICS—Continued

exercises of Frederick the Great, and the tactical side. In the latter, a group of officers representing the commander and his subordinates can go thru a campaign of several days' duration in all its details.

In all the above exercise the training and measurement of the officer is considered apart from the instruction of the troops. In all modern armies the troops are trained in actual maneuvers, which differ from the map problems in that the ground replaces the map and the troops are real. The tactical problems are the same, but new elements are introduced, human fatigue and misunderstanding.

While the officer capable of applying his tactical knowledge and judgment in a map maneuver may not be a success in the field, it is certain that one who is a failure in map maneuvers cannot be a successful troop leader under field conditions.

—Joint Operations—Army and Aircraft

See also

FIELD ARTILLERY—FIRE CONTROL—AERONAUTIC

—Joint Operations—Army and Navy

See also

LANDING OPERATIONS

—Joint Operations—Navy and Aircraft

See also

COAST DEFENSE—USE OF AIRCRAFT IN

—Offensive vs. Defensive

See also

ARTILLERY—FIRE—LONG RANGE

[The War on Land. *Army & Navy Gazette & Brood Arrow,* Aug 25, '17. 150 words.]

The Germans are in a plight in the defense of their front lines. The smashing capacity of the British artillary makes the German front line trenches untenable, whatever the strength of the German garrison. Therefore, the German command has been forced to rely upon counter-attacks to save their front lines. These offensive returns have proven so costly in men, however, that the German units have a conviction that the counter-attack method of defense cannot succeed.

[The Passing of the "Pill Box." *Scientific American,* Oct 20, '17. 1600 words.]

When the Germans learned that their heavily cemented trenches could no longer withstand the ever-increasing superiority of allied gun-fire, and that their deep concrete dugouts proved to become traps in which their men were captured by the Allied infantry advancing behind the barrages, they introduced this year what is called the "Pill-box" defense. The "Pill-box" is the British soldier's name for a small, round, concrete block house which contains a number of German machine gunners. The "Pill-box" strategy of this year comprises the use of shell holes, trees, rocks, and every other available shelter for machine guns, instead of the old-style rows of trenches. In other words, there is no system of positions, but merely a "zone of defense." The organization of this zone is such that the aerial observers of the Allies cannot detect the individual machine-gun posts; hence direct hits by artillery become almost impossible except by mere chance. The troops holding positions in the defense zone are in echelons, beginning with slight density in front and increasing in density toward the rear, where special shock regiments and regular infantry are held in force for counter attacks.

The Germans expected in this scheme of defense that their scattered machine gunners would be protected during preliminary bombardments and barrage fire, and that after the barrage had passed over them they would open fire from their posts on the enemy infantry. The object of this fire would be to so weaken the attacking infantry that the German counter attacks would succeed in restoring conditions as they were before the battle.

In this defense the machine gun posts are well camouflaged. Immediately behind the first line shell hole centers of resistance there should be dugouts for shock troops and reserves, otherwise these will have to be assembled and held in readiness in the open. Barbed wire plays a prominent part. Not only is a more or less continuous line used in front of the first line shell holes, but also lines are used thruout the defense zone for directing the attacking troops into a most favorable position for the German machine gun fire.

The British and French have spoiled this "Pill-box" defense by greatly increasing their artillery fire, thus increasing the probablity of hitting each and every "pill-box" and shell hole position. The recent advances of the Allies have been made after an intense bombardment of the defensive zone, and under the protection of a greatly improved barrage. Also, the Allies' scheme of assigning definite objectives and of planning every detail beforehand has kept the advancing troops well within the range of their artillery support. The enemy counter attacks have proved futile and costly. His "Pill-box" defense is a failure.

[Opening of the Flanders Battle. By Hilaire Belloc. *Land and Water,* Aug 9, '17. 2300 words. 2 sketches.]

During the last winter the relative superiority of the Allies in munitionment and guns increased, and this year a new plan developed on both sides. The character of this plan was clear after the close of the first spring offensive in front of Arras and in Champagne.

This plan was to fix limited objectives, the occupation of which would involve a comparatively short advance; to break the elaborately organized enemy front *completely* over a given stretch of the line, by prolonged and accurate bombardment; to occupy this limited belt immediately; and then to prepare the next blow upon such defenses as the enemy should have organized behind. Such blows, each strictly limited, but following each other rapidly, would by their limitation be less expensive in men; would compel the enemy to highly expensive counterattacks, and should, in general, make his inferior force lose at a much greater

rate than the superior force pressing him. The culmination of such repeated blows would ultimately leave the enemy in a situation where he could not maintain his line.

To meet this plan imposed upon him by the superiority of his opponent the enemy proposed this system of defense: To hold his elaborate front organization as thinly as possible, to preserve by the saving thus effected considerable reserves upon a second line about 2000 yards behind the first, or more; to admit thus the impossibility of holding his elaborately organized front line under the first attack, but to attempt its recapture by strong and necessarily expensive counterattacks while the assault was still in confusion after its first success. All the fighting for the Aisne Ridge has shown these characteristics and they will appear without doubt during this great battle of Flanders which has just begun.

The success of the offensive will depend upon the rapidity with which it can organize each successive blow, and upon its ability to compel the enemy to lose men in a far greater proportion than do his assailants. The success of the defensive will depend upon its power of retarding such blows and of inflicting loss upon the assailants during counterattacks beyond the assailants' calculations.

[Views of a German Expert. *Army and Navy Jour.*, Nov 24, '17. 450 words.]

Lieut. Gen. von Ardenne, the German military critic, has written an account of the recent British offensive in Flanders from that front. No way, he says, has been devised to prevent the "fire roller," as the Germans term the moving barrage, from making slow and steady gains. He reports the German losses as very heavy if an attempt is made to hold the front line trenches in force, while a thin line adds to the speed of the British advance.

"The suffering of the defenders in the front line," General von Ardenne writes, "composed of shell holes almost filled with water, are such that the men must be relieved every two days, instead of every week or ten days as last year. The infantry now spends two days on the firing line, two in support and two in reserve until relieved. The German artillery is so numerically inferior to the British that it is seldom relieved, and as it cannot dig in owing to the boggy terran it must fire without cover. The conditions in the shell holes are such that men falling into the center of them are lost unless assisted. Horses breaking into the morass are shot because it is impossible to extricate them. German counterattacks can traverse the fire roller only by small detachments in single file. The loss is slight if the maneuver succeeds—otherwise!"

—Tactical Units

See

Company—Tactics

TAITAO, Peninsula of

See

Chile—Military topography of

"TANKS"

See

Automobiles—Armored

TARAPACA, Battle of

[Critical Study of the Battle of Tarapaca. By Otto Wasehold A., Chilean Army. *Mem. del Ejército* (Chile), Nov, '16. 9300 words.]

The battle of Tarapaca was fought on the 27th of November, 1879. The allied forces (Peruvians and Bolivians) were commanded by General Buendia, while the Chilean forces were commanded by Colonel Orteaga.

In this study the writer discusses:

(a) The causes which led to the battle.

(b) Positions occupied by both belligerents the day before the battle.

(c) The Chilean plan of battle. The forces were divided into three columns.

(d) Positions occupied by both contending armies during different phases of battle, which resulted in the defeat of the Chilean forces.

(e) Tactical dispositions adopted and mistakes made.

TARGET PRACTICE

See also

Cavalry—Fire—Target practice

Infantry fire—Instruction and training—Target practice

—Coast Artillery

See

Coast artillery—Target practice

—Infantry

See

Infantry—Fire—Instruction and training—Target practice

TAUROGGEN (Convention of)

See

Prisoners (of war) (Article: "An Historical Parallel.")

TELEGRAPHY

See

Wireless telegraphy

—Apparatus and Equipment

[Laying Telegraph Cables Under Fire. By Capt. A. P. Corcoran, late of the British Army. *Popular Science Monthly*, June, '17. 1200 words. Illustrated.]

Air lines are used from general to brigade headquarters, and cable from thence forward. A four-horse wagon, four mounted men, four men on the wagon, and two drivers form the unit for laying wire. Four drums, each five miles of No. 14 insulated copper wire are carried. Wire is laid from the reels, circuit being kept by axle contact. The four mounted men cover the cable at crossings and place it along the road.

For laying cable in the trenches a different system is used, a "man pack" taking the place of the wagon. This pack comprises four men. One man drives pegs in the side of the trench to support the cable, which is carried in 2000 yard reels of No. 18 wire. One

TELEGRAPHY—Continued

man lays cable and two follow and tie the cable in place on the pegs. Duplicate lines are used to diminish the danger of interruption by shell fire.

The cable wagons make good targets for airplanes. In the retreat from Mons two were destroyed in succession in an attempt to place a line. A third accomplished the task.

The communication service is very efficient. Communication along the front is equal to that provided in cities in point of rapid service.

—Military Control of

[The Telegraph System of an Army During War Time. By L. J. *Tidskrift i Fortification*, parts 3 and 4, '16. 2300 words.]

(Differences in the national telegraph service in war and peace. Distinction between operations at home and in the war area. Personnel required for upkeep. New construction, and operation of permanent lines; direction and control of these lines. Organization of the telegraph service in the Army, both on the march and on the field of battle.)

TELEPHONY

See also
WIRELESS TELEPHONY

—Apparatus and Equipment

[Telephone Developments in the Artillery Service. By H. T. Davidge, Esq., B.Sc. M.I.E.E. (Professor of Electricity, Ordnance College). *Jour. Royal Artillery*, Apr, '16. 3500 words.]

It is common knowledge that the telephone plays a most important part in the artillery service of today and to an extent not at all realized under peace conditions.

Before the war there were telephones for coast defense purposes and quite different telephones for field purposes.

The development of trench warfare has established conditions along the front much akin to those of coast defense, which conditions exist side by side with field conditions, and this state of things has led to various developments in telephone equipment. The gunner is not encouraged by the official hand-books to look into the inner workings of his instrument, as skilled artificers are available to make repairs. On the other hand, large classes of officers are constantly sent for instruction in the construction and working of telephones. Frequently, upon returning to their units, these instructed officers are given no opportunity to put into practice what they have learned at the school. When officers who have had a systematic course in telephones return to their units, they should be given every opportunity and encouragement to practice what they have learned.

The essentials necessary in all telephones are: a battery, a transmitter, a receiver, a calling device, an induction coil, and a condenser.

(The lecturer performed various experiments to illustrate the action of these devices and their function in the telephone. He then exhibited and explained the various service telephones, including the coast defense and field telephones, telegraph sets, earth connections, receivers, mine detecting microphones, and telephone exchanges.)

The subject of the telephone is a complicated one and the following special points were emphasized: the inaccuracy of resistance calculations owing to the use of fluctuating alternating currents, the necessity for system in finding telephone faults, and the need of care in selecting operators in order to insure accuracy and speed in the transmission of messages.

—Apparatus and Equipment—Field Equipment

[The Electrical Principles Involved in the Field Telephone. By Major H. L. Crosthwait, R.E. *Jour. United Service Inst. of India*, Jan, '17. 3900 words. Diagrams.]

The telephone has practically replaced all other forms of communication in trench warfare and for observation of artillery fire. On account of likelihood of wires being broken by movement of troops and transport and by shell fire, it is not absolutely dependable. Operators should thoroly understand every principle and detail on which the telephone depends. Simple, non-technical language is used to describe the electrical principles involved.

The field telephone is more portable than the ordinary instrument, and in addition is adapted for the use of Morse code. Morse signals will act thru greater resistance than speech, and may be read when the din of battle makes the latter unintelligible. The article divides the field telephone into the following component parts, and considers each separately: (1) the battery, (2) the induction coil, (3) the vibrator or buzzer, (4) the transmitter, (5) the receiver, (6) the condenser. The units *Ohm, Amphere,* and *Volt* are defined and their relationships indicated by a simple equation.

Under *The Battery*, a typical dry cell is discussed. Its construction and composition are described and formulas show the chemical action which takes place while in use, showing why such cells are suited for intermittent use. A fresh cell will have a voltage of 1.5 and should be discarded when this falls to 1.2. Dry batteries are hermetically sealed and cannot be repaired.

The Induction Coil. A magnetic field surrounds every wire in which a current flows. By varying or interrupting the current this field shrinks, expands or collapses. If this moving field intersects another wire it induces therein an intermittent alternating current. The first wire is called the primary, the other the secondary. In practice the primary is made of a few turns of thick wire, and the secondary of many turns of fine wire. This arrangement transforms a large current of low voltage into a small current under high voltage. High voltage is needed to overcome resistance in the line wire. Coils in field telephones are usually three or four inches long by one inch in diameter, and are wrapped on a soft iron core.

The Vibrator. A soft iron core becomes a magnet when current flows around it. A spring placed in the circuit with one free end opposite the core will be drawn to the latter when it becomes magnetized; thus breaking the circuit. The circuit broken, magnetism ceases and the spring, released from the core, restores

the circuit. This operation, repeated many times a second, causes the spring to buzz and earns for it the name buzzer. A key placed in the circuit to interrupt this buzzing, is used to make the Morse dots and dashes.

The Transmitter. Sound is transmitted thru the air by a series of vibrations or waves, very complex in the case of the human voice. The transmitter converts these air vibrations into current waves by providing a resistance which varies under the influence of air vibrations of different intensity. The circuit passes thru a cup containing polished spherical granules of carbon. The sound waves impinge against the thin carbon disc or diaphragm, which forms the cover of the cup, and cause it to press with varying intensity against the granules lying loosely behind it.

The resulting change in resistance varies the current in the primary and induces a similar current, but of much greater intensity, in the secondary and line wire. The receiver reconverts these currents into sound waves at the other end.

The Receiver. A polarized electro-magnet is a combination of a permanent and electro-magnet. In the receiver, an iron disc or diaphragm is supported close over the poles of such a magnet. Variations in the strength of the magnet, due to variations in the current along the line wire, cause this iron disc to bend and vibrate in a feeble imitation of the original vibrations of the transmitter at the other end. A buzzer makes this diaphragm vibrate so rapidly that a musical note is produced. This sound is used as a call signal or to send Morse code.

The Condenser consists of a number of plates of tinfoil lying between sheets of insulating material, such as parffined paper. The odd number plates are joined together. Since only alternating currents can pass thru this device, by its use a telegraph wire in operation may also be used for a telephone or buzzer, without interrupting the telegraph message. Also, the condenser makes it possible to tap another telephone circuit. A diagram illustrates the combination of the component parts and the article explains their working as a whole.

These simple tests and remedies for failure may be applied by the operator; (1) Depress the Morse sending key. A loud buzz should be heard in the vibrator. If a weak buzz is heard, the battery is weak. If no sound is heard, either the battery is run down or the circuit is broken. Examine for a loose connection. (2) Connect the terminal binding screws with a short wire. Press down the Morse sending key. The receiver should emit a loud sound. If no sound is heard the receiver cord may be broken or connections loose, or the receiver may be short-circuited. Absence of sound might be due to the diaphragm touching the magnet or a break in the magnet winding. However, these last defects are unusual. (3) Without disconnecting the binding screws press down on the transmitter key. The receiver should click loudly both on depressing and releasing the key. If no sound is heard the connecting cord may be broken, the transmitter may be broken or short-circuited internally, or the carbon granules may be sticking together. Shake up the granules by tapping on the transmitter.

TELESCOPE

See also

Field artillery—Fire control—Instruments and equipment

Periscopes

TENTS

—Horse

See

Horses—Stables and tentage

TOPOGRAPHY, Military

See

European war—Topography of

Maps and mapping

Siege artillery—Maps for

Sketching

TORPEDOES

—Aerial

See also

Barlow aerial torpedo

Grenades

[New Aerial Torpedo.—Fundamental Principles which Should be Followed in the Development of a Spanish type for the Air Service. By Ricardo Aranas, Brigadier General. *Memorial de Artillería,* Nov, '16. 13,500 words.]

Our aviators, as well as those of other armies, are using at the present time a type of drop bomb or aerial torpedo, which, altho it has produced some effect, is not believed to be as efficient as it should be, especially when taking into account recent improvements and developments in explosives.

For example, up to the present time bombs carrying charges of only 3 to 10 kgs. have been used, instead of bombs of greater power and destructive effect, which will be indispensable as shown by operations in the war now being conducted by the Spanish in Africa.

The new type should be developed along the lines of the two above mentioned, but including in it the most recent developments in explosives in order to obtain increased effect and at the same time to be safe in handling.

The special features of interest are those relating to the initiation of detonation, and may be briefly described as follows:

(a) Initial Energy. Obtained by means of a special type of primer which amplifies it to the highest degree possible.

(b) Multiplying apparatus of a special form and construction, designed to obtain the greatest detonating effect.

(c) Increased effect of the charge, obtained by modifying the charge and its detonation.

With reference to the initiating energy, this subject was treated fully by the writer in a pamphlet, *New Explosives,* published in 1911, in which the characteristics of initiating primers were stated with special reference to the use of such primers as regulators of the character of the explosion or detonation.

In this new type, it is proposed to use an initiating primer composition of lead azide, (N_6 Pb), carried in a copper cylinder and in contact with an initial multiplier of tetralita, (tetranitro-methylaniline=C_7 H_5 N_5 O_8.)

TORPEDOES—Continued

(On account of the deficiencies in Spanish nomenclature, the notation is difficult to follow. All of the explosives mentioned are fully described in "Explosives" (Marshall), and the notation used in the translation is based on that authority. For example, the writer speaks of *nitrito de plombo*. It appears that the explosive is lead azide, and not lead nitrite.)

The following advantages are claimed for lead azide:

It can be compressed to a high degree without losing its force or detonating power.

It is sure in action when compressed.

It is non-hygroscopic.

An equal volume gives an initial shock ten times greater than mercuric fulminate.

The first multiplication is obtained in the initiating primer in a manner similar to that employed in detonating fuses, and in this case by means of a small cylinder of tetralita (C_7, H_5 N_5 O_8), of 0.8 grams weight.

The second multiplication is also obtained by means of a similar device. A larger cylinder of steel is provided carrying 25 to 30 grams of trilita, (T. N. T.). This substance is assembled with less compression than the tetralita on account of its lesser density. It gives a wave velocity of about 7000 meters per second.

The third multiplication is accomplished by means of various lengths of a fuse train, consisting of lead tubing, filled with tetralita and laid in the compressed charge of trilita in a manner similar to reinforcing bars in reinforced concrete. The lengths of fuse train are laid in such a manner as to bring the ends together at a point where contact may be had with the second multiplier or with a small quantity of trilita between them. The explosive wave which circulates through the fuse train is transmitted at a velocity of about 11,500 meters per second, until it reaches the middle or central point of each length, the fuse train lengths burning from each end, when the explosive wave is raised to about 20,000 meters per second and thus initiates complete detonation of the charge. An appendix gives the laws upon which the rates of transmission of the explosive waves are based.

[A Time-Controlled Aerial Torpedo. By Willard G. Moore. *Aviation,* Dec 15, '16. 1600 words. Illustrated.]

Reports from Europe tell of a self-propelled torpedo which travels parallel to the surface of the earth to any given calculated range, under its own power, when released from a skid beneath the biplane. It then dips of its own accord to its target and explodes upon striking it. To this type, however, too much credence should not be given, altho detailed reports have reached this country. Only types of bombs that have rapidly reached a satisfactory experimental stage and have actually given satisfaction in practical tests will be considered in this article. One very successful type is the emergency torpedo, which involves the conversion of different types of high explosive projectiles into aerial torpedoes at a moment's notice and can be assembled very expeditiously in the field, being suitable for use as a drop bomb. It also provides an economic use for shells that are defective due to errors in manufacture. The common faults of shell manufacture appear in defective threads or too thin bases, but most common of all is failure to undergo the hydraulic pressure test of 20,000 pounds per square inch thru the existence of a porous cracked base. While a projectile of this nature is perfectly good for a drop bomb, the weak base would not withstand the powder pressure in the gun (diagram is given with description of the British 4.5 inch field gun projectile converted into an aerial torpedo). It is well known that there is not a single artillery projectile fired out of a gun that has not in its fuse attachment a time control in direct relation to its time of flight, and the absence of this in the aerial bomb has been only too apparent in the European War. It appears that an improvised sleeve or jacket has been placed over the exterior of the projectile to be dropped. The prongs of this sleeve projecting out radially from the axis are in a measure to retard the burying propensity of the bombs. This expedient has produced some good results but must offer great resistance to the downward flight of the torpedo with a tendency to make it tumble. The ordinary combination time fuse starts burning by the ignition of the concussion primer induced by the pressure exerted upon the base of the projectile at the initial impulse of discharge in the bore of the gun. The aerial torpedo described accomplishes the same thing in the following way: the aviator calculates his distance from the target and sets the nose of the bomb opposite the graduation that corresponds to this distance. The momentum of the first fifty feet fires the auxiliary primer; this is accomplished by the propeller fastened to the shaft, which by a rotary motion releases itself by means of the screw thread and drops its spherical end free of the stirrup cup-spring. The spring then recoils to its former shape and allows the plunger forced by the spring to go up with its primer upon the firing pin. The flame is carried thru the vent to the cylinder of plaited rope powder composition which burns away, allowing the plunger stem to imbed itself in the cavity forward, being forced down by the spring. Then for the first time the picric acid booster charge is allowed to increase itself around the detonator. The element of danger in other constructions is that the detonator is nearly always in the midst of the main explosives. The impact detonator is located in the rear of the stem. The inventor of the above torpedo was at one time on the staff of General Villa. This torpedo has been dropped at night from altitudes varying up to 7000 feet. During these tests it was noticed very distinctly that the torpedo had a parabolic curve, described thru a resultant high arc trajectory. During the tests from the higher altitudes the torpedo could not be seen. The attained velocity was in some cases as great as 700 feet per second. The approach of these bombs was preceded by a shrill whistling sound, probably caused by the propeller blades; next a terrific explosion occurred, the air being driven against the faces of observers who were stationed fully a half mile distant. These bombs weigh approximately one hundred pounds each.

—Defense Against

See also

SUBMARINES—DEFENSE AGAINST

—Naval

See also

SUBMARINES (Article: "Torpedoes and Submarines")

[Accurate Measurement of Torpedo Ranges. By Lieut. Francis S. Craven, U. S. Navy. *Proc. U. S. Naval Institute,* July-Aug, '16. 5000 words. Diagrams plots.]

In the increased use and range of torpedoes it has become essential to determine and check the ranges so as to determine accurately the characteristics of the torpedo when fired. A geometrical method of using the observing ship as a base line is described by Lieut. Craven, who claims an accuracy of observation to 10 yds. error up to 4000 yds.

[Points on the Torpedo. Editorial. *Scientific American,* July 21, '17. 800 words.]

The largest torpedoes are 21 inches in diameter and about 20 feet long. They have a range of about 10,000 yards and a speed of about 40 knots. The war head contains over 300 lbs. of high explosive, detonated by a fuse with plunger projecting from the point.

The Germans use a torpedo of this type, but in designing a torpedo for use on submarines, a range of about 2000 or 3000 yards and a speed of about 30 knots appeared sufficient. With the arming of merchant vessels, so that submarines could not sink them by gun fire, more torpedoes had to be carried as they were the only weapon available for the submarine. An early type of 14-inch Schwarzkopf with range of only 1500 to 2000 yards is being used, the war head charge being doubled at a sacrifice of speed and range. The submarine tries to get within 1000 yards, preferably 500 or 600 yards, before firing torpedoes, and it is doubtful if they would attempt to fire at over 1500 or 1800 yards except at a very slow ship.

The depth at which a torpedo runs is controlled by a diving rudder operated by a diaphragm subject to the pressure of the water. The depth can be controlled as required by the draught of the vessel attacked.

United States

[Note. *Army & Navy Jour.,* Feb 10, '17. 100 words.]

To carry out prepared plans for doubling the output of the naval torpedo station at Newport, R. I., the Secretary of the Navy has asked Congress for an immediate appropriation of $800,000. Reasons of economy are behind the project, the Navy Department having estimated that about $2,000,000 will be saved on the initial order placed at Newport.

TORPEDOPLANES

[The Torpedoplane. By Rear-Admiral Bradley. A Fiske, U. S. N. *Flying,* Mar, '17. 1630 words. Illustrated.]

The torpedoplane, which will become an important factor in naval warfare in the near future, is a scheme whereby a regular Whitehead torpedo can be launched as effectively from an airplane as it can from a torpedo boat or destroyer. The destroyer goes toward the enemy at a speed of about 30 knots and launches a torpedo from its deck. The torpedo goes ahead under its own power, and, if aimed correctly, strikes its target under the water-line, disables and sinks it. With the torpedoplane the aviator approaches his target from a height of several thousand feet, and when several miles away volplanes close to the water, and when a few feet above the water and pointing toward his target releases the torpedo. The torpedo falls into the water exactly the same as if dropped from a destroyer. An Italian aviator tried it out two or three years ago and hit the target nine times out of ten at 3000 yards. A year ago a British naval lieutenant sank four Turkish vessels in the sea of Marmora, using 14-inch Whitehead torpedoes weighing 731 pounds each. In a combat between a torpedoplane and a ship, the advantage is all on the side of the torpedoplane. It is at an unknown height above the water and range from the ship and can change its position at will. For attacking a large size battleship, a torpedo weighing about a ton will be best. It can be launched from a distance of several miles. Light torpedoes can be used against destroyers, colliers, ammunition ships, scout cruisers and transports on account of their thin sides. In most cases, on account of the rolling of the ship and the resultant inaccurate gun fire, the torpedoplane could approach within a few hundred yards before discharging its torpedo. Altho we are far behind the other nations of the world in the number of aviators, our national security could be brought to a hopeful state by establishing, say, 50 torpedoplanes at each of our ten important naval districts and a few on the airplane mother ship.

[Defending America with Torpedoplanes. By Rear-Admiral B. A. Fiske, U. S. Navy. *Popular Science Monthly,* May, '17. 1800 words. Illustrated.]

The torpedoplane may prove to be revolutionary in naval tactics, as was the advent of the armored ship. The torpedoplane is a combination of the use of the torpedo and airplane. It is possible to launch a torpedo from an airplane, and the torpedo will then propel itself in the direction of its target. The airplane carrying the torpedo will offer a poor target for a gun mounted on a rolling platform on account of the motion and the difficulty of ranging. Experiments were made in Italy with a similar invention, and it is reported that four Turkish vessels were sunk in the Sea of Marmora by torpedoes launched on four flights by an airplane.

[The Fiske Torpedo-Plane. By Park Benjamin. *Independent,* May 12, '17. 950 words.]

The torpedo-plane, invented by Rear Admiral Bradley A. Fiske, U. S. N., has been used successfully by the Germans and English. The British steamer *Gena* of 2784 tons was sunk May 1, 1917, by a torpedo discharged from a German seaplane off Suffolk, England. Some time ago Lieut. Boyle of the British Navy simi-

TORPEDOPLANES—Continued

larly sunk four Turkish vessels in the sea of Marmora. Admiral Fiske's invention consists of a mobile torpedo similar to the torpedoes projected under water by submarines, supported on an airplane frame directly below the aviator's seat and so arranged that by pulling a single lever it is freed and its propelling engine started. The torpedo-plane is launched either from land or from the deck of a ship, rises some 6000 feet and stays at that elevation until its target is sighted, whereupon it rapidly descends at a precipitous angle. If the objective is a weak vessel the plane may approach to within 1500 yards before firing; but if armed vessels are attacked this distance is increased. The torpedo's nose at the moment of release is pointed directly at the target. The release occurs when the plane is about 20 feet above water. The torpedo automatically takes a certain depth and a speed of about 35 miles per hour.

In the writer's opinion the torpedo-plane could be used effectively against the German navy at anchor in the harbors of Kiel and Wilhelmshaven.

TRAINING CAMPS

[Results of First R. O. T. C. *Army & Navy Jour.*, Aug 18, '17. 500 words.]

The lists of the graduates of the first series of Reserve Officers' training camps have been made public, and show that almost 27,000 out of 44,000 attending received commissions, or about 70 per cent. The original expectation was about 25 per cent. The lists show 18,032 line officers, 2000 Q.M.C., 2000 Aviation Section, Signal Corps, 2200 Coast Artillery and Engineers, 300 Ordnance, and 160 Intelligence (A. G. Dept.). There had been previously listed a total of 9243 officers of various branches (chiefly 2331 Infantry, 3044 Engineers, and 1340 Q.M.C.) in addition to 9225 Medical Reserve Corps officers.

[The Story of the Training Camps. By H. S. Drinker. *National Service*, Sept, '17. 3200 words.]

(A history of the training camp movement in the United States from the establishment of the first Students' Camp at Gettysburg in 1913 to the discontinuance of the civilian training camps upon the entry of the nation into the Great War. When this latter step was decided upon, the Training Camp Association tendered to the Secretary of War the services of its organization thruout the country for aid in enrollment of men for the Officers' Reserve and the establishment of the training camps. The further activities of the Association are described.)

Canada

[Impressions of a Great Canadian Training Camp. By the Editor of the *Scientific American*, Nov 25, '16. 1000 words.]

The camp at Valcartier covers a perfectly level plateau, 17,000 acres in extent. A macadamized road three miles long furnishes the main artery of traffic. On each side of the road are the tents of the camp.

Recruits were being practiced in rushing trenches. In the trenches were straw-stuffed dummies for bayonet work. Fifty yards in rear were bundles of sticks swung from poles, also used for bayonet work.

There is a wonderfully complete system of instruction trenches, reproducing in every detail the trenches of the western front, and built under the direction of officers invalided home. Thus the Canadian contingents become familiar with trench work before leaving for the front.

A concealed machine gun position was examined. When entered it appeared completely closed, but there was an embrasure which could be opened. From the outside it was impossible to locate the position. At a word of command, a long narrow strip of turf lifted and revealed the muzzle of a machine gun.

There are 1600 separate targets on the rifle range. This number was necessary during the training of the first 30,000 men of the expeditionary force. Firing is at 200 to 250 yards. Disappearing targets, painted to merge with the background, are used.

TRAJECTORY

—Graphical Determination of

[Mechanical—Graphical Method of Constructing High Angle Fire Trajectories. By Capt. Curti (Switzerland). *Schweiz Zeit. f. Art. u. Genie*, Apr, '16. 2000 words. Illus.]

Given the coefficient of form c, the angle of departure and the initial velocity V_o, required to construct the trajectory graphically, and determine at any point the tangential direction of the projectile tan δ, the velocity V, and the time of flight t.

The tables of Siacci are used, in which for any velocity v, the air resistance is given as a f (v). The retardation is then

$$g = -c.\ f\ (v)$$

in which according to Siacci,

$$c = \frac{(2R)^2}{G} . \frac{d}{1206} . 865\ i$$

(2 R=caliber in meters; G=weight of the projectile in kg.; d=density of the air in gr. per cub. m.; and i=form coefficient.)

The method is as follows:

1. The fundamental quantities V and are obtained graphically by constructing the velocity curve from point to point.

2. It is assumed that the law of air resistance is known and that the ballistic coefficient for the particular case is given.

3. The values of V and are then referred to the X-axis by making use of Henry's Equation.

$$x = \frac{2}{g} . F$$

in which F, the area of the hodograph sector between V_o and V, is equal to The curve $y_1 = f\ (x)$ is obtained by plotting several points with their tangents, each being obtained independently of the preceding one.

4. The trajectory itself is obtained by the mechanical integration of the equation $y_1 = f(x)$.

5. The method applies to both high and low velocities and is especially useful in calculating the trajectories of howitzers and anti-aircraft guns.

TRANSPORTATION

See also

SUPPLY AND TRANSPORT

TREATIES OF PEACE

[Termination of War and Treaties of Peace. By Coleman Phillipson, M.A., LL.D., Litt.D. (T. Fisher Unwin. 21s. net.) From the London *Spectator*, Oct 28, '16.]

"Mr. Coleman Phillipson has written a useful book on the way in which wars come to an end, and on the treaties of peace which follow them. His work, which has two good indices, a list of judicial cases referred to in the text, a list of the works and documents drawn upon, and also appendices containing the texts of all important treaties signed since the Treaty of Paris in 1815, will prove a mine from which diplomatists and statesmen may draw facts and precedents. As Mr. Phillipson explains in his preface, the object of his book is to consider, first, the methods of terminating wars without recourse to treaties of peace, either by cessation of hostilities or by conquest and subjugation, and next, the normal way of ending wars by the concluding of a treaty of peace. Further, the part played by neutral states in bringing the hostile parties together is described. The book is one which by its nature is rather for reference than for general reading; but those who have time to study the work in detail will find much food for thought."

TRENCH-FOOT

[Trench Chiropody. *Scientific American*, Dec 16, '16. 700 words.]

During the winter of 1915-16, many men were disabled by "trench-foot," or frost-bitten feet. The disease was serious enough to require amputation in some cases, and in others even to cause death. The disease occurs at times when the temperature is above freezing, humidity being a contributing factor. Poor circulation induced by tight footwear or puttees is another cause, hence the caution to keep the feet warm and dry, and avoid constriction of the feet and legs.

Two French bacteriologists, Raymond and Parisot, have discovered that the worst cases of "trench-foot" are caused or accompanied by a parasitic fungus. In other words, the soldiers' feet become mouldy.

The fungus is found in straw, manure, stable-bedding, and in mud. When thru frost-bite or exposure to low temperature while wet, the feet become blistered, the fungus enters and develops with great rapidity, causing rapid degeneration of tissue which soon brings about conditions that may require amputation. Serious general debility may also result.

The treatment recommended is to wash with borated camphorated soap. This destroys the fungus growth and the swelling subsides in three or four days, tho neuritic pains may continue two or three weeks. Disinfection with this soap and suitable safeguards against sluggish circulation (friction, cold plunges, rubbing with snow, etc.) will serve to prevent the disease.

[One Job of the Staff Captain. *Sphere*, May 26, '17. 1200 words.]

The staff officer goes ahead to make arrangements for the care of the men when they come into the line. Every brigade has its own system. The danger of "trench-feet" was learned the first winter. A man with "trench-foot" is as much a casualty as one who has been shot. Now every man working or standing in a wet place has long rubber waders (gum boots, thigh).

Every man also has a wool-lined leather coat, and there are a number of short oilskin coats for use in wet weather. The expensive trench coat is rarely seen. Waders and short oilskins are cheaper and far more serviceable.

Warmth and drying places are essential. The drying rooms are manned by older or light-duty men, not quite fit for trench work. Here the task is to keep a sufficient supply of dry rubber boots that the relieving units can go into the trenches dry shod. Men going into the trenches put on the dry rubber boots and take their leather boots with them. On returning they leave their wet rubber boots to be dried and put on their leather ones again. The drying rooms also have compartments for drying socks. There are also arrangements for massaging the feet and applying an anti-frostbite preparation. A case of "trench-feet" is the signal for an outbreak of censure extending up to the Corps commander.

Hot meals must be provided, and now the man farthest front has three hot meals a day. There are baths even in the most forward areas, and provisions for washing clothes. The baths are run on a schedule by units, so as to use their full capacity. Canteens for the sale of articles practically at wholesale cost are run, sometimes by divisions, sometimes by brigades and even by battalions.

All these arrangements are important to the health and morale of the command, and the staff officer must provide for them.

TRENCH MORTARS

See

FIELD ARTILLERY—MATERIEL—TRENCH MORTARS
GRENADES—USE OF IN EUROPEAN WAR (Article: "Types of Metal Grenades and Grenade Guns")
TACTICS (Article: "Modern Battle Tactics")

[Light-weight Trench Mortars for a Moving Army. *Scientific American*, June 2, '17. 220 words.]

The British army has adopted a light trench mortar known as the Stokes gun, after its inventor, Wilfred Stokes. This mortar, which can be easily carried forward by charging infantry, consists of a thin-walled barrel equipped with light-weight, but rigid supports, which can be adjusted so as to give the barrel the desired elevation and direction. The mortar can be carried conveniently by one man, and can be erected and operated in an improvised trench or shell hole.

TRENCH MORTARS—Continued

The most deadly collection of diversified ammunition is now made for the mortar, so that it is proving an invaluable offensive weapon.

TRENCH RAIDS

See
RAIDS—TRENCH

TRENCH WARFARE

See also
RAIDS

TRENCHES

See
ENTRENCHMENTS

TROOPS

See
ARMY

TUBERCULOSIS

[Report of the United States Army General Hospital, Fort Bayard, New Mexico. Washington Government Printing Office, 1916.]

(This report naturally is of interest chiefly to the medical profession. We remark, however, that "for the treatment of tuberculosis, the peculiar excellence of the climate of Fort Bayard consists in the fact that it is one that avoids harmful extremes of temperature, yet in its diurnal and annual variations affords a sufficient stimulus to the human organism to favor activity of the metabolic processes." The number admitted during the year was 738.)

TUNNELS AND TUNNELING

[War Tunneling Extraordinary. By E. F. *Sphere,* Sept 1, '17. 850 words. Illustrated.]

Of the many remarkable examples of underground shelters which the Allies have discovered in territory wrested from the Germans, the largest and most elaborate is the great tunnel-redoubt beneath Mont Cornillet, captured by the French in their Moronvilliers offensive last spring.

It consisted primarily of three parallel tunnels, opening on the northern slope of the height about 100 feet below the summit. The tunnels ran into the hill for over 200 yards, and were about 60 yards apart. Their typical cross section was: bottom width 11 feet, top width 8 feet, height 7 feet 6 inches. Each was designed to shelter a battalion of 1000 men. They were connected by a transverse tunnel about 60 yards from the entrances. The system was provided with administrative posts, telephone stations, a hospital, and depots of food and ammunition. Ventilation shafts to the surface were provided and two of the tunnels had Decauville tracks laid in them to handle supplies.

At the time of the French attack there were six companies of infantry in the tunnels. Few of them again saw the light of day. During the terrific fire preparatory to the attack a French 400 mm. shell crashed into the eastern tunnel at its juncture with the cross gallery, destroying the ventilation shaft, the commander's post, and much of the adjoining tunnels. The other openings were choked by the bombardment, and the hermetically sealed galleries were left full of the fumes of the exploded shells. Almost the entire garrison perished either from the explosion or by asphyxiation.

TURKEY

—Army

See also
EUROPEAN WAR—FORCES ENGAGED—CENTRAL POWERS
EUROPEAN WAR—FORCES ENGAGED—TURKEY

—History

See also
EUROPEAN WAR

TURRETS, Armored

See also
FORTIFICATIONS—PERMANENT—ARMORED TURRETS

UNIFORMS

Colombia

[Uniforms of the Colombian Army. By Capt. C. C. Smith, U. S. Cavalry. *Jour. U. S. Cav. Assn.,* Jan, '17. 1200 words.]

(This article is in the nature of advice as to the character of uniform suitable for the Colombian army, based upon the experience of the U. S. Army in Cuba and in the Philippines.—ED.]

A uniform should have protective coloration, and be of suitable material. Our (U. S.) first color was the earth-color khaki, later replaced by the olive drab, because it blends better with a green landscape. A light woolen undershirt under the olive drab shirt is better, as it absorbs perspiration and has several advantages over a cotton undershirt. A good uniform for tropical wear consists of drab felt hat, olive drab wool shirt, light woolen undershirt, cotton olive-drab trousers, white cotton short drawers, light gray wool socks, russet leather shoes, and olive drab puttee leggins.

The hat is better than the helmet for the field. The Colombians might well use the Panama hat. Whatever is found good by civilians for similar purposes may well be adopted by the army. We have taken several items from the cowboy equipment.

Light woolen socks are better than cotton, and trousers are preferable to breeches for infantry in campaign. Woolen drawers and trousers and a fleece-lined overcoat or other equal garment would make the uniform suitable for higher altitudes or colder climates.

France

[Procedure Employed in France to Renew the Clothing of the Army. By Lt.-Col. D. José Rodríguez de Rivas. *La Guerra y su Preparación,* Mar, '17. 650 words.]

Supply of clothing is obtained by repair of old clothing and by purchase and manufacture of new. All the purchased or repaired clothes are received in regional storehouses, whence they are distributed to the clothing depots and to the general reserves. Thence they go to the front. Four thousand wagons were necessary for the distribution of winter clothing.

From the 15th of September 80 wagons left the depots daily for the front. The clothing included Bayonne vests, mufflers, gloves, extra blankets, breeches of cotton flannel, shirts of the same, socks and bands of wool. In addition there were, for individuals, sheepskins, overshoes of impermeable cloth, wooden shoes, high rubber boots, impermeable jackets, mountain shoes, snow shoes. The winter equipment weighs from 13 to 14 kilos, in addition to the 30 kilos of the normal equipment.

Each corps makes fortnightly a double requisition. Other requisitions may be made in emergency. One copy goes to the Chief of the Line of Communications, who transmits it at once to the clothing depot. The depot endorses on the requisition a note of the clothing forwarded, and returns it thru the Chief of the Line of Communication to the division quartermaster. The second copy is sent to the division quartermaster, who compares it with the copy from the depot. The division quartermaster thus can supervise the timely sending of requisitions, put a check on excessive requests, and see what has been actually furnished.

—Footwear

See also

SHOES AND BOOTS

[Footwear. By Capt. J. H. Van Horn, 22d Infantry. *Infantry Jour.*, Oct, '17. 800 words. 2 tables.]

Data collected from personal observation of three companies of the First Provisional Training Regiment (493 men) concerning the wearing qualities of the present issue marching shoes and leggins are set forth in two tables. Following recommendations concerning the marching shoe are made: (1) The shoe should be half-soled with chrome-tanned leather, or a full length sole added to the present sole; (2) Protection of the stitching of the back stay from the rubbing of the legging; (3) Secure fastening of the sole to the shoe at the welting on the inside, near the instep. Half soles and extra lifts on the heels added to new shoes will prolong the time that they will retain their proper shape and serviceability and add to their foot supporting qualities. The new canvas leggin should be improved by reinforcing with leather along the middle seam for about five inches from the bottom, by substituting a rawhide for the present canvas instep strap, and by taking precautions against the pulling out of the hooks.

—For Artillery

[Completing Military Camouflage with Camouflage Robes. *Scientific American*, Sept 29, '17. 180 words.]

A gun crew must be camouflaged as well as their gun in order to prevent discovery by hostile airmen. The French have introduced a bizarre form of camouflage robe which is worn over the usual uniform. The garment includes a hood and a mask which completely enclose the head, while a suitable camouflage paint design breaks up the outlines in the desired manner.

—Headwear

See also

HELMETS

—Insignia

[Uniforms and Badges. By Major Fred R. Brown, Infantry. *Infantry Jour.*, Aug, '17. 3200 words.]

(A very condensed description of the French, German, British, and Belgian uniforms, with distinguishing marks of various branches of the service and badges of rank for officers, impossible of further condensation. The customs of the British service as regards saluting and conduct in regimental mess are given.)

—Salvage of

[An Example of Thrift. *The Canadian Military Gazette*, Jan 9, '17. 200 words.]

Near Paris there is an establishment for making over used British uniforms which are gathered up on the battlefield, brought in and sorted. Those too ragged to be repaired are sold for junk, the remainder are repaired, cleaned, disinfected, made over and reissued. About 140 men and 500 women are thus employed. The rags bring about $425 per ton, and the saving effected is over $230,000 a month.

Another establishment in which 20 men and 170 women are employed has taken over the repairing of rubber boots worn in the trenches. Over 100 pairs of boots are repaired daily, at an average cost of about 12 cents per pair.

UNITED STATES

—Aeronautics

See also

AERONAUTICS—UNITED STATES
AERONAUTICS—MATERIEL—UNITED STATES
AERONAUTICS—INSTRUCTION AND TRAINING—UNITED STATES
AERONAUTICS—ORGANIZATION AND ADMINISTRATION—UNITED STATES
DIRIGIBLES—UNITED STATES
UNITED STATES—COAST DEFENSE—USE OF AIRCRAFT IN

[Insurance Against War Surprise by Aeroplanes. By P. Y. Alexander. *Flying*, Nov, '16. 1400 words. Illustrated.]

There are 600,000,000 people in Europe today fighting or making munitions. The isolation of America is gone forever, for the "U" boat has opened undersea highways populated with lurking unseen enemies. What the "U" boat has done, aircraft can do much more rapidly and easily. The flight will not be half so hard to make, as Blériots fly from the French coast to the British coast. The advent of aerial warfare has extended tremendously the responsibilities and activities connected with national defense. Aircraft make raids day and night, and nothing excepting superiority in aerial armament can meet the issue. There are not fewer than 500,000 people in the British air service alone. Aeroplanes are in flocks everywhere. We have hundreds of small dirigibles, less than 300 feet long, equipped with aeroplane bodies instead of the usual nacelle. They are capable of staying in the air fifty hours and go at a speed of about thirty-five miles per hour. They are very useful for submarine and coast defense.

UNITED STATES—Continued

There are also hundreds of kite balloons in use. These are distributed along the coast and along the front at intervals of a few miles. Great Britain is spending $250,000,000 for aeronautics this year, and is spending more for American-made motors and aeroplanes than the American government.

—Army

See also

DECORATIONS AND REWARDS, MILITARY—UNITED STATES
EUROPEAN WAR—FORCES ENGAGED—UNITED STATES
NATIONAL ARMY (U. S.)
RECRUITING
UNITED STATES—MILITARY POLICY OF

[The American "Million Army." By Dr. Leo Brenner. *Infantry Jour.*, Feb '17. 1900 words.]

(Translated from the *Berliner Zeitung*, May, 1916. An exposé to the German people of the military inefficiency of our country. The author shows that the Congress might easily vote to raise a million soldiers, but that the result would be much as if the French Chamber of Deputies were to vote to have a victory some clear day. He discloses the futile attempts at recruiting and mobilization in the past, with which errors most Americans are familiar.)

[Land Forces of the United States. *Army & Navy Jour.*, Feb 10, '17. 800 words.]

The total personnel of the United States Army on Feb 1, 1917, can be estimated with almost official exactitude at 118,000 men and 5000 officers. This number falls short of the authorized strength on that date by about 2000 officers and about 13,000 men.

—Army—Artillery

See

COAST ARTILLERY—MATERIEL—UNITED STATES
FIELD ARTILLERY—HEAVY—UNITED STATES
MACHINE GUN—MATERIEL—UNITED STATES

—Army—Cavalry

See

CAVALRY—DRILL REGULATIONS—UNITED STATES
CAVALRY—EQUIPMENT—UNITED STATES
CAVALRY—ORGANIZATION—UNITED STATES
CAVALRY—UNITED STATES

—Army—Engineers

[Vast Task of Army Engineer Corps. *Official Bulletin*, Nov 14, '17. 1000 words.]

The Corps of Engineers of the Army has expanded from 2500 officers and men to 100,000 officers and men since Apr 6, 1917. In addition nine railroad regiments and one forestry regiment have been raised as part of the National Army. At the same time that this great increase and reorganization has taken place, the engineers have had the duty of purchasing and delivering the necessary engineer equipment for more than 1,000,000 men; of constructing, transporting, installing and putting into operation overseas complete railroad equipment for our armies; of organizing and equipping special troops for special services, such as lumber supply, road construction, sanitary construction, camouflage service, gas and flame service, mining work, mapping, etc. In addition to all these duties the Engineer Corps has maintained its regular service in the preservation and improvement of navigable waters in the United States, and in the construction of coast defenses.

—Army—General Staff

[Status of General Staff Determined. *Army & Navy Jour.*, Nov 18, '16. 4500 words.]

(Opinion of the Secretary of War concerning the effect of Section 5 of the National Defense Act.)

Under existing laws, the General Staff corps consists of a constantly changing detail of officers brought from the line of the army and returned thereto, and so representing the opinion of the army upon technical military subjects. Section 5 of the National Defense Act specifies the duties on the General Staff shall be employed, the purpose being to prevent its employment on duties of an administrative nature that pertain to established bureaus or offices of the War Department.

The interpretation of this language must be based upon a correct understanding of the intention of Congress in the act of Feb 14, 1903, establishing the General Staff and universally regarded as a most important piece of army legislation. The discussion of the subject by Secretary Root is informing, and in that discussion the relation of the Chief of Staff to the Secretary of War is set forth. For the Chief of Staff he desired powers of co-ordination, supervision, and control, in the name of the Secretary of War wholly different and greater than those previously entrusted to the commanding general of the army.

In creating the General Staff, Congress intended "to supply to the Secretary of War a lawfully authorized military adviser to whom all other heads of departments and bureaus should report, and thru whom the Secretary of War should be constantly kept advised and informed; that it should be the duty of this officer, aided by the General Staff Corps created by the act, so to advise himself of all the operations of the military departments and bureaus of the War Department as to inform the judgment of the Secretary upon any question submitted for his decision," and to guard the Secretary against difficulties due to his unfamiliarity with military affairs.

The General Staff was created to secure co-ordination, to obviate existing difficulties. If Congress deemed it a failure and decided to abandon the experiment, it would not have been done in the tentative, obscure and admonitory language of the Defense Act.

There is no adequate ground for the belief that Congress meant to leave to the Chief of Staff the duty of co-ordinating the functions of the military bureaus of the War Department and at the same time prohibit that degree of supervision necessary to equip him with the qualifying information. The plain meaning of the prohibition against work of "an administrative nature" is that neither the Chief of Staff nor the General Staff Corps shall administer the offices of the bureau chiefs. The duties of correlating, informing and supervising are not administrative.

The Chief of Staff being the military advisor of the Secretary of War, he must be sufficiently informed as to the operation of the bureaus to know if the policy decided upon by the Secretary of War is being carried out.

"The policy of the War Department, therefore, will remain as heretofore: the Chief of Staff, speaking in the name of the Secretary of War, will co-ordinate and supervise the various bureaus, offices and departments of the War Department; he will advise the Secretary of War; he will inform himself in as great detail as in his judgment seems necessary to qualify him adequately to advise the Secretary of War." The Chief of Staff will prepare any regulations or orders necessary to enforce this decision.

—Army—Infantry

See also

INFANTRY—INSTRUCTION AND TRAINING—UNITED STATES
INFANTRY—ORGANIZATION—UNITED STATES
INFANTRY—UNITED STATES

—Army—Officers

[Training Officers for Our Army. *Army & Navy Jour.*, May 26, '17. 550 words.]

Brig.-Gen. Henry P. McCain, the Adjutant-General of the Army, says that America is to have the best army, both in officers and men, that she has ever had at the beginning of hostilities, because it is to be a selected army, a hand-picked army, from top to bottom, both as to officers and men. He says that the sixteen officers' training camps might be called new West Points to the extent that the officers who have planned them and are managing them are determined that the spirit of those camps shall be the spirit of the U. S. Military Academy. These camps contain 40,000 men chosen by a most rigid selective process. This selected raw material is to be further tested by three months of experience and instruction at the rate of 47 hours of hard work a week. The courses are designed, according to Gen. McCain, to teach as thoroly as possible in the short time available, the duties of an officer; first, as instructors by subjecting the future officers to the same drill and individual training and discipline that they in turn must give to their future commands; second, as managers, by showing them how to feed and care for the welfare and sanitation and comfort of their future commands; third, as leaders, by illustrating the tactical employment of troops and by giving each an opportunity for practice in tactical leadership.

[All Together, Soldiers! By Major Richard Stockton, Jr., U.S.O.R.C. *Jour. Mil. Service Institution.* July-Aug, '17. 3500 words.]

(The interests and aims of all branches and arms of our land forces should be welded together. There has been too much infantry, too much cavalry, too much of the various other branches of the service, and not enough *army*. The interests should be united, not divergent. Therein lies the task and the opportunity of the *Military Service Institution of the United States* and of its *Journal*. Every member of the service should be on the rolls of the institution and receive its *Journal*. Steps to that end are proposed and a plea made to all hands to join in an effort at unification.)

[Officers Graduated from the First Series of Training Camps. *Official Bulletin*, Aug 20, '17. Quoted.]

The Adjutant General's Office has compiled the following table showing officers graduated from training camps conducted from May 15 to Aug 14, 1917. All have been assigned duty with the 16 National Army divisions or elsewhere, and, with few exceptions, report for duty Aug 29:

Rank—	Inf.	Cav.	F.A.	C.A.C.	Eng.	Q.M.	Ordnance. Stat.	Ordnance. Sup.	Ordnance. M.G.	Provisional second lieuts., Reg. Army. Inf.	Provisional second lieuts., Reg. Army. Cav.	Provisional second lieuts., Reg. Army. F.A.	Provisional second lieuts., Reg. Army. C.A.C.	Tot's.
Colonels *	2	...	...	...	...	...	...	...	..	...	...	...	...	2
Lieutenant colonels	1	...	...	...	...	...	...	...	..	...	...	...	...	1
Majors	141	18	25	1	50	...	...	...	..	...	...	...	...	235
Captains	2,274	251	547	170	419	...	...	61	..	...	...	...	...	3,722
First lieutenants	2,315	258	684	170	747	...	75	123	80	...	...	...	...	4,452
Second lieutenants	8,376	955	2799	497	750	3067	77	121	..	1375	178	510	224	18,929
Total	13,109	1482	4055	838	1966	3067	152	305	80	1375	178	510	224	27,341

*Appointed in 1916. Attended training camps and recommended for retention in service.

—Army—Organization

[The United States Military Law of June 3, 1916 *Rev. Mil. Suisse*, Dec, '16. 1000 words.]

The new strength will be obtained in five years. At least such is the theory. What will happen in practice? This proceeding presupposes voluntary enlistments in sufficient numbers, which is extremely far from being sure.

The enlistment contract is for seven years, three in the active army and four in the reserve. However, the Secretary of War can allow any soldier judged to be sufficiently instructed and trained to pass into the reserve at the end of a year's service.

It is understood that the object of this provision is to attract desirable men who would balk at the idea of long active service. But it seems open to criticism for, in the first place, the law does not make exemption at the end of a year a right of the enlisted. Therefore, it is to be feared that political or other

UNITED STATES—Continued

influences will bring about the liberation of men capable of making good non-commissioned officers.

The law improves, theoretically still, the reserve system. A curious innovation is the pay of 25 dollars a year for reservists, in time of peace. The purpose of this is merely to allow the administration to keep in touch with the reservists; the military authorities, in fact, have not here the same means of action as in Europe. The reservists are not even called out for fixed and obligatory periods of instruction. That is why many people are skeptical as to the number and the physical aptitude for war service of these reservists when the day of mobilization may come.

Several sections of the law deal with reserve officers. These officers are appointed after examination; it is not necessary that they should have belonged to the regular army or national guard. However, they have presumably taken part in several sessions of those business men's camps which are in reality good schools for non-commissioned officers, of infantry especially. One of the sources from which these reserve officers are obtained is the universities, colleges and academies.

* * *

It has been said of the law that it has finally *federalized* the national guard, in the sense that to-day, in case of war, this part of the army passes automatically into the federal service by the simple promulgation of a mobilization order. In practice, unfortunately, the only difference from the old régime is that the delays inherent to the administering of the oath will be avoided. In fact, it will still be necessary to make the militiamen pass a thorough physical examination, since experience has proved that the national guard has a deplorable tendency to enroll individuals unfit for campaign. Besides, the law virtually admits this.

The officers may be recognized by the federal government only after they have passed the prescribed examinations before a board appointed by the Secretary of War. This remedies the drawbacks of the system of election still in use in certain states.

A *Reserve of the National Guard* is prescribed, but the law enters into no details as to its organization. (The national guard enlistment is six years, of which the three last are spent in the reserve.) It specifies, however, that these reservists shall draw no pay, except when they are called out for instruction periods with the active guard.

A more efficacious innovation, in our opinion, is the creation, in case of mobilization, of a depot battalion in each national guard regiment called into the federal service.

The minimum number of ordinary drills is 18 per year (of an hour and a half each) instead of 24. Besides, the units must take part in 15 days' maneuvers or target practice; under the old law, there were hardly more than 8 to 10 days' maneuvers or rather camping out. Sometimes, even, these "encampments" took place only every other year.

It remains to be seen what this new organization will be worth in practice.

[Composition of the New Army. *Army & Navy Jour.*, May 5, '17. 325 words.]

We are able to give herewith for the first time the tentative plan drawn up by the Army War College and submitted to the General Staff, dealing with the composition of the army to be developed from the first 500,000 men called by the President under the selective draft provisions of the new army bill. The plan provides for the following:

DIVISIONS				
16 Infantry divisions	each	913 officers and	27,243 men.
16 Divisional Hospitals	each	24 officers and	222 men.
64 Camp Infirmaries	each	.. officers and	2 men.
2 Cavalry Divisions	each	607 officers and	16,021 men.
2 Divisional Hospitals	each	24 officers and	238 men.
6 Camp Infirmaries	each	.. officers and	2 men.
Medical Corps	total	288 officers and	1,000 men.
Coast Artillery Corps	total	666 officers and	20,000 men.
ARMY CORPS TROOPS				
16 Brigades F. A. (heavy)	each	48 officers and	1,319 men.
8 Aero Squadrons	each	10 officers and	154 men.
8 Balloon Companies	each	19 officers and	154 men.
10 Field Hospitals	each	6 officers and	73 men.
10 Ambulance Companies	each	5 officers and	150 men.
22 Field Bakeries	each	1 officer and	67 men.
6 Telephone Battalions	each	10 officers and	215 men.
16 Pack Companies	each	.. officers and	14 men.
6 Ammunition Trains	each	4 officers and	852 men.
6 Supply Trains	each	2 officers and	426 men.

Grand total, all units: 18,538 officers, 528,659 men.

The officers for this force will be drawn from the Regular Army and the National Guard, the Officers' Reserve Corps and the "country at large." The War College recommended that 200,000 men be withdrawn from the army and Guard (when both are recruited to full authorized strength) for appointment as company officers and non-commissioned officers in the new army. The college advised against any estimate which would give less than 150,000 men from this source.

It is the specific purpose of the War Department that each regiment in the new forces shall be commanded by an officer from the Regular establishment, and that at least one of his majors and all of the staff officers (adjutant, ordnance, supply officer, etc.) shall be experienced men from the Regular Army.

[Expansion of the Regular Army. *Army & Navy Jour.*, May 19, '17. 1200 words.]

When the expansion is complete, the Regular Army will include seven full divisions: four infantry and two cavalry within continental United States; one division in the Philippines; and the additional troops in the Canal Zone and Hawaii. Orders for the expansion of the other arms such as the coast artillery, signal, and hospital corps, may be expected soon. Later will come the addition of regiments of heavy artillery —attached to no divisional organization, but under the orders of corps commanders. At least four regiments of this type are to be found. The present plans of the War Department do not contemplate any cavalry divisions organized strictly as such in either the first quota of the new National Army or in the National Guard. The slight and relatively unimportant use of cavalry on the western front has indicated that the

mounted forces already in France are ample for the time being. Altho the cavalry units of the new army will be used dismounted, the new units of the Regular Army will be thoroly equipped with mounts should other service (on the Mexican border, for instance) be found for them.

The Secretary of War has notified all bureau chiefs that he will give no consideration to proposed changes in organization, equipment, uniform or anything which is not of vital importance in preparation for, or in the conduct of the present war.

[Four Increments for Regular Army. *Army & Navy Jour.*, May 19, '17. 1450 words. Quoted.]

The Secretary of War authorized on May 14 the issuance of orders for the raising of the remaining four increments to the Army as contemplated under the National Defense Act. Following this it was announced, on May 15, that the President had authorized the raising of all the remaining increments of Engineer troops as contemplated in the National Defense Act, and that orders would be sent out at once to fulfill this authorization.

The "splitting" of existing regiments and the recruiting to full strength of the resulting new organizations to form a total of twenty-seven regiments of Infantry, twelve of Field Artillery and six of Cavalry was the tremendous scope of the orders dispatched to the department commanders on May 14. All of the old regiments and battalions involved are to be drawn from the Southern Department—comprising practically all of the veteran regiments that have been on border duty since 1912. The modus operandi will be the same as was employed on July 1, 1916, when the initial increment was added. Designations of the new regiments will be from the 38th to the 64th, inclusive, of Infantry; 10th to 21st, inclusive, of Field Artillery; and 20th to 25th, inclusive, of Cavalry.

When the new regiments have been obtained the Army will, therefore, comprise sixty-four regiments of Infantry, twenty-one Field Artillery, and twenty-five of Cavalry—a total of 110 regiments—exclusive of Engineers, Coast Artillery, staff corps and special service units. There will be 3379 officers, and 127,985 men in the Infantry, 1325 officers and 37,145 men in the Cavalry, and 897 officers and 26,748 men in the Field Artillery. The entire Regular Army will comprise more than 12,000 officers and 293,000 men.

The actual strength of the Regular Army on May 13, 1917, is given as 176,545, making an additional recruiting of 116,455 necessary to fill the war maximum of 293,000 now called for. Since Apr 1, 67,443 men have been added to the Army, and it is hoped that the additional number needed may be obtained by June 15.

The new regiments will be in addition to the National Guard and to the draft army of 500,000. When raised to war strength the Guard will contain 329,954 men. No orders have been issued covering actual war mobilization of the National Guard. The War Department is understood to be waiting action by Congress on the Emergency Army bill.

RECRUITING AND ORGANIZATION STATIONS

The recruiting and organization stations are announced as follows:

Eastern Department

Second Increment: 38th-39th Infantry, Syracuse, N. Y.; 12th Field Artillery, Fort Myer, Va.

Third Increment: 47th, 48th, 49th, 50th Infantry, Syracuse, N. Y.; 15th Field Artillery, Syracuse, N. Y.

Fifth Increment: 58th, 59th, 60th, 61st Infantry, Gettysburg National Park; 19th, 20th Field Artillery, Montauk Point, L. I.

Southeastern Department

Fourth Increment: 51st, 52d, 53d, 54th, 55th, 56th Infantry, Chickamauga Park, Ga.; 22d, 23d Cavalry, Chickamauga Park.

Central Department

Second Increment: 40th, 41st Infantry, Fort Snelling, Minn.; 42d, 43d Infantry, Fort Douglas, Utah; 45th and 46th Infantry, Fort Benjamin Harrison, Ind.; 10th, 11th Field Artillery, Fort Riley, Kas.

Third Increment: 20th, 21st Cavalry, Fort Riley, Kas.

Fourth Increment: 16th, 17th Field Artillery, Sparta, Wis.

Southern Department

Second Increment: Nothing.

Third Increment: 13th, 14th Field Artillery, Fort Sill, Okla.

Fourth Increment: 57th Infantry, Douglas, Ariz.; 18th Field Artillery, El Paso, Texas; 64th Infantry, El Paso, Texas; 21st Field Artillery, Camp Wilson, Texas.

Western Department

Second Increment: 44th Infantry, Vancouver Barracks, Wash.

Russell, Wyo.

A résumé from the above of the location of new regiments by arms of the Service is as follows:

Fifth Increment: 62d, 63d Infantry, The Presidio of San Francisco, Cal.; 24th, 25th Cavalry, Fort D. A.

Cavalry—20th and 21st, Fort Riley; 22d and 23d Chicakamauga Park; 24th and 25th, Fort D. A. Russell.

Field Artillery—10th and 11th, Fort Riley; 12th, Fort Myer; 13th and 14th, Fort Sill; 15th, Syracuse; 16th and 17th, Sparta; 18th, El Paso; 19th and 20th, Montauk Point; 21st, Camp Wilson, Texas.

Infantry—38th and 39th, Syracuse; 40th and 41st, Fort Snelling; 42d and 43d, Fort Douglas; 44th, Vancouver Barracks; 45th and 46th, Fort Benjamin Harrison; 47th, 48th, 49th, 50th, Syracuse; 51st, 52d, 53d, 54th, 55th, 56th, Chickamauga Park; 57th, Douglas, Ariz.; 58th, 59th, 60th, 61st, Gettysburg National Park; 62d and 63d, Presidio of San Francisco; 64th, El Paso.

OLD REGIMENTS TO BE DIVIDED

The following existing units of the Army will be divided to form the nucleus for the new regiments to be organized, it was announced on May 15:

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Regiment; new station; to organize:
30th Inf., Syracuse, N. Y., 38th and 39th Inf.
9th Inf., Syracuse, N. Y., 47th and 48th Inf.
23d Inf., Syracuse, N. Y., 49th and 50th Inf.
4th F. A. (less 2d Battn.), Syracuse, N. Y., 15th F. A.
2d Battn. 3d F. A., Fort Myer, Va., 12th F. A.
4th Inf., Gettysburg, Pa., 58th and 59th Inf.
7th Inf., Gettysburg, Pa., 60th and 61st Inf.
7th F. A., Montauk Point, L. I., 19th and 20th F. A.
11th Inf., Chickamauga Park, Va., 51st and 52d Inf.
6th Inf., Chickamauga Park, Va., 53d and 54th Inf.
11th Cav., Chickamauga Park, Va., 22d and 23d Cav.
36th Inf., Fort Snelling, 40th and 41st Inf.
20th Inf., Fort Douglas, 42d and 43d Inf.
8th F. A. (less 1 battn.) Fort Riley, 10th and 11th F. A.
13th Cav., Fort Riley, 20th and 21st Cav.
8th F. A. (2 battns.), Sparta, Wis., 16th and 17th F. A.
14th Inf. (2 battns.), Vancouver Barracks, 44th Inf.
12th Inf., The Presidio, 62d and 63d Inf.
1st Cav., Fort D. A. Russell, 24th and 25th Cav.
5th F. A. (less 3d Battn.), Fort Sill, 13th and 14th F. A.
5th F. A. (3d Battn.), El Paso, Texas, 18th F. A.
34th Inf., El Paso, Texas, 64th Inf.
3d F. A. (1st Battn.), Camp Wilson, Texas, 21st Inf.
19th Inf., Douglas, Ariz., 57th Inf.
10th Inf., Fort Benjamin Harrison, 45th and 46th Inf.

Orders were issued on May 15 for the movement from the border to the designated points of thirteen regiments of Infantry, three of Cavalry, and four of Field Artillery. They go to the mobilization points thruout the country where the forty-five new regiments of Infantry, Cavalry and Field Artillery, which the President authorized, are to be organized.

ENGINEER CORPS INCREASE

The increase in the Corps of Engineers will add four new regiments to the three now existing, to be organized from the two regiments now in the United States; the 3d Regiment, Col. T. H. Rees, now on overseas duty, in the Philippines, Hawaii and the Canal Zone, will remain as organized at present. Under the plan adopted by the War Department the 1st Regiment of Engineers, Col. M. M. Patrick, and the 2d Regiment of Engineers, Col. G. A. Zinn (now in the United States) will be reorganized into the 1st, 2d, 4th, 5th, 6th and 7th Regiments, as follows:

Cos. A and B, 1st Engineers, into 1st Regiment Engineers, at Washington Barracks, D. C.

Cos. A and B, 2d Engineers, into 2d Engineers, in Southern Department.

Cos. E and F, 2d Engineers, into 4th Engineers, at Vancouver Barracks, Wash.

Cos. C and D, 2d Engineers, into 5th Engineers, in Southern Department.

Cos. C and D, 1st Engineers, into 6th Engineers, at Washington Barracks, D. C.

Cos. E and F, 1st Engineers, into 7th Engineers, at Forth Leavenworth, Kansas.

In addition to the above, the one mounted company of Engineers now in existence will be reorganized into two mounted battalions.

[New Regimental Designations. *Army & Navy Jour.*, July 7, '17. 600 words.]

[Discusses the plan adopted by the General Staff for assigning consecutive numbers for regiments in each branch of the service, including Regular Army, National Guard, and National Army. Designations of regiments in the regular army remain unchanged. National Guard regiments follow consecutively with state designation in parenthesis, as 66th Infantry (1st Maine). The National Army regiments take numbers after the National Guard with the locality in which raised in parenthesis, as 205th Infantry (W. Va.)]

[Numbering Our Army Units. *Army & Navy Jour.*, July 21, '17. 200 words. Table.]

A scheme of numbering the new army units has been approved by the Secretary of War. Regiments will be numbered serially in each branch of the service, beginning in the Regular Army at 1, in the National Guard with 101, and in the National Army with 301. National Guard units will be distinguished by their old designations in parentheses, thus: 123d Infantry (1st S. C.) Regiments of the National Army will show by parentheses their locality.

Brigades of each branch of the service will be numbered serially, beginning at 1 in the Regular Army, 51 in the National Guard, and 151 in the National Army.

Infantry divisions will be numbered serially beginning at 1 in the Regular Army, 26 in the National Guard, and 76 in the National Army.

The cavalry divisions of the Regular Army will be numbered beginning at 16.

[Suggested Changes in Tactical Units. *Army & Navy Jour.*, July 28, '17. 1000 words.]

(Certain changes in divisional organization, reducing the strength to 17,000 men with correspondingly increased number of divisions, are discussed. These changes have not yet been decided upon.)

An important change in organization, already ordered, involves the equipping and training of eight regiments of cavalry (18th to 24th, inclusive, and one other not yet designated) as light artillery, the armament to be the three-inch guns. Corresponding changes in the National Guard cavalry regiments have been discussed but no decision has yet been reached.

[Important Changes in Army Organization. *Official Bulletin*, Aug 8, '17. 800 words.]

Under a new order, the infantry division will comprise—division headquarters; one machine gun battalion of four companies; two infantry brigades of two regiments and one machine-gun battalion each; one field artillery brigade of three regiments and one trench mortar battery; one field signal battalion; one train headquarters and military police; one ammunition train; one supply train; one engineer train; and one sanitary train of four field hospital companies and four ambulance companies.

The new organization will make the strength of a division about 19,000 men, as compared with a strength of 28,000 under the former organization.

[New Organization of the Army for Overseas Service. *Official Bulletin*, Sept 22, '17. 850 words. Quoted.]

The following statement completely outlines the new United States Army organization for overseas service:

At maximum strength an Infantry regiment will comprise 103 officers and 3652 men. It will be made up as follows:

	Officers and men.
1 headquarters and headquarters company	303
3 battalions of 4 rifle companies each	3,078
1 supply company	140
1 machine gun company	178
1 medical detachment	56
	3,755

Each rifle company has a strength of 250 men and 6 officers. It is composed of a company headquarters (2 officers and 18 men) and four platoons. Each platoon includes:

	Officers and men.
1 headquarters	2
1 section bombers and rifle grenadiers	22
2 sections riflemen, 12 each	24
1 section auto riflemen (4 guns)	11
	59

Machine Gun Company

The machine gun company has 6 officers and 172 men. It consists of the headquarters (3 officers and 21 men), 3 platoons (each with 1 officer and 46 men), and a train (13 men). Its armament is 12 machine guns of heavy type and 4 spare guns.

The transportation equipment of the regiment is:

22 combat wagons.
16 rolling kitchens.
22 baggage and ration wagons.
16 ration carts.
15 water carts.
3 medical carts.
24 machine gun carts.
59 riding horses.
8 riding mules.
332 draft mules.
2 motor cycles with side cars.
1 motor car.
42 bicycles.

New fighting equipment for each regiment, in addition to the usual rifles, bayonets, pistols, etc., includes 480 trench knives (40 to each company, 192 automatic rifles (16 to each company), and 3 one-pounder cannon manned by the one-pounder cannon platoon of the regimental headquarters company.

Each regimental headquarters company is made up of 7 officers and 294 men, as follows:

One headquarters platoon (93 officers and men) including 1 staff section (36 officers and men), 1 orderlies section (29 men), 1 band section (28 men).

One signal platoon (77 officers and men) including 1 telephone section (51 men), 1 section with headquarters (10 men), 1 section with 3 battalions (16 officers and men).

One sappers' and bombers' platoon (43 officers and men) including 1 section sappers (9 men) for digging and special work, 1 section bombers (34 officers and men).

One pioneer platoon (55 officers and men) for engineer work.

One one-pounder cannon platoon (33 officers and men).

* * * * * *

The following summary of the organization of an infantry division completes the general outline of organization of the United States Army for service in Europe. The figures are the total of officers and men for each entry. Each infantry division comprises:

1 division headquarters	164
1 machine gun battalion of 4 companies	768
2 infantry brigades, each composed of 2 infantry regiments and 1 machine gun battalion of 3 companies	16,420
1 field artillery brigade composed of 3 field artillery regiments and 1 trench-mortar battery	5,068
1 field signal battalion	262
1 regiment of engineers	1,666
1 train headquarters and military police	337
1 ammunition train	962
1 supply train	472
1 engineer train	84
1 sanitary train composed of 4 field hospital companies and 4 ambulance companies	949
	27,152

Artillery Ratio Increased

The new organization increases the ratio of artillery and machine gun strength to infantry. In place of the old division of three brigades with three infantry regiments in each are two brigades with two infantry regiments in each. But in the new, as in the old organization, there are three regiments of field artillery in each division, making the ratio of artillery to infantry regiments three to four, in place of three to nine. A trench mortar battery, added to the artillery brigade, and a one-pounder platoon, attached to each infantry regiment headquarters company, adds to the gun strength of the division.

Machine Gun Strength

A division now includes a total of 14 machine gun companies. Each of the four infantry regiments has one; each of the two brigades has a machine gun battalion of three companies; and the division has a machine gun battalion of four companies. This gives each division a mobile machine gun strength of 10 companies, which can be used as special needs require, while each regiment still has its own machine gun equipment in one of its component companies. And in addition, there are 48 sections of auto-riflemen, each

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section carrying four light machine guns (automatic rifles), one section in each of the four platoons making up each rifle company.

—Army—Personnel

See also

UNITED STATES—MILITARY POLICY OF—COMPULSORY MILITARY SERVICE

[Disposition of Negro Soldiers. *Army & Navy Jour.*, Aug 11, '17. 500 words.]

The War Department has gone no further in its plans regarding the disposition of negro troops than to decide to organize them into separate regiments. Junior officers will be supplied from the negro training camp at Des Moines.

It is estimated that 750,000 negroes were registered on June 5, indicating a quota of about 57,000 in the first draft, or about three divisions.

[Negro Regiments for France. *Canadian Military Gazette,* Oct 9, '17. 45 words.]

Four regiments of negro stevedores are being organized in New York for service at certain French ports in unloading from steamships supplies for American troops. The commissioned officers of the regiments will be white men.

—Army—Reserve

See also

TRAINING CAMPS

[From U. S. Geological Survey, Department of the Interior, Feb, '16.]

Secretary Lane has approved the applications of 93 topographic engineers in the United States Geological Survey, Department of the Interior, for commissions in the Engineer Officers' Reserve Corps of the Army. This corps is established in conformity with the general plan, now being rapidly worked out by the War Department, to organize and have instantly available for active service in time of need a large number of specially qualified men. The topographic surveys and maps made by the Geological Survey are recognized as absolute war necessities and this Survey is now carrying on special field work in co-operation with the Engineer Corps of the Army to produce military maps. The field engineers of the Geological Survey are all men of special training and wide experience.

The remaining 70 applications from topographic engineers have been forwarded by the Director of the Geological Survey to Secretary Lane, who has transmitted them with his approval to the War Department.

The total number of applications for army commissions thus far submitted amounts to 80 per cent. of the topographic field force of the Geological Survey.

[A Reserve Army. By Brig.-Gen. John F. Morrison, U. S. Army. *The Military Historian and Economists,* Jan, '17. 7000 words.]

The majority of our people are convinced that we must have a military force large enough to meet the first rush of an enemy, but we must yet settle the question of how to obtain such a force without too great cost and too large a standing army. Such a force must consist of citizen soldiers, but unless they be efficient there is no solution. Efficiency would demand that all officers, non-commissioned officers and the specialists (cooks, clerks, etc.), in each unit be thoroly competent and that the remainder be so trained that, with a skeleton of thoroly trained men, the whole can be made fit for service in a few days. The organization must be such that mobilization can take place quickly, and the process must be simple. The entire force must be under one authority. Since the national guard cannot fulfill the required conditions, the following substitute therefor is proposed:

I—ORGANIZATION OF A RESERVE ARMY. STRENGTH

20 Complete Infantry Divisions.
3 Cavalry Divisions (each 3 brigade, 2 regiments each.)
120 Companies Coast Artillery.
15 Battalions Heavy Field Artillery.

Location

The country to be divided into 20 divisional districts, each district to furnish an Infantry Division. The Coast and Heavy Field Artillery to be assigned to districts for recruitment. Cavalry Divisions to be stationed in sections where horses can most easily be obtained and cared for. In assigning troops, advantage must be taken of any previous training in any trade or profession. In each district there should be a camp site large enough for a complete division camp, place for drills, a target range, etc.

Equipment of Division Camps

On these camp sites there should be erected storehouses large enough to hold the equipment of a division and in them should be kept every thing (except horses and mules) for prompt mobilization. Barracks for the men and quarters for officers of the permanent garrison should be built.

Enlistment for the Reserve

The term of proposed service is six years, three with the colors and three with the first reserve. Boys from 18 to 24 years are to be allowed to volunteer; if not enough, remainder to be conscripted. Men for various organizations to be furnished by the districts in which they are located and, preferably, by voluntary enlistment but by conscription if necessary.

Active Service

Active service for the first year shall be for 13 weeks, from June 13 to Sept 11: the second and third years, 8 weeks each from July 17 to Sept 11.

The Reserve

When the army is mobilized the reserve must report and enough men to fill the units to war strength will be taken from those last to leave the colors. The troops remaining, and not attached to the second reserve army, will be held at the camps, and, with the new recruits, will undergo training until needed to replace men at the front.

Officers and N. C. Officers

Certain well qualified regular officers will be assigned to each division, such officers not to receive any increased pay or rank except when the troops are mobilized. A thoro yearly inspection will be made and any officer whose work is not excellent will be summarily relieved.

All other officers of these organizations will be army reserve and will be obtained from two sources:

(a) Vacancies in the grade of second lieutenant in the regular army will be filled as follows: One-half as now, permanent in the arm or corps; the other half to serve in the regular army for two years and then to be transferred to the reserve for at least five years, being advanced one year upon such transfer.

(b) Second lieutenants in the reserve army will be obtained by promotion of N. C. officers of the same regiment, and vacancies in the grade of first lieutenant not filled by transfer from the regular army to be filled by promotion of second lieutenants in the same regiment.

To obtain properly qualified N. C. officers, cooks, etc., one instruction company will be formed from each regiment; these companies, in the infantry, to form three battalions of three companies each, corresponding to three brigades.

Enlisted Men for Training Companies.

At the end of the training period (Sept 11) nine volunteers will be accepted from each company forming thus in each regiment a provisional training company of 108 men. These companies will serve from Sept 11 to June 13, and during this time will be carefully instructed and trained. The following June the necessary number of these men are made N. C. officers in the companies from which they came; they also instruct the recruits who join June 13. The first sergeant and cook of each training company will be permanent. Machine gun training companies will be similarly formed.

Officers of the Training Units

The colonel (division commander) will command the training camp, and the chief of staff (a captain) will be adjutant, while the captains who are to command regiments will command training companies, and the chief Q. M. will be post Q. M. of the training camp.

Regular officers detailed to the division will receive the pay and allowances of their actual grade except when the divisions are mobilized. All other officers, while in the service of the U. S. will draw the pay of their corresponding grade in the regular army, and no pay at other times.

II—The Second Reserve Army

After the above described divisions have been organized for six years and men are passing out of the reserve army, there will begin the organization of a duplicate division in each district and these will constitute the Second Reserve Army. They will be organized by transferring to them men from the reserve army who have completed their tour therein. A complete skeleton organization will thus be built up and will have assigned to it a few regular army officers as division and brigade commanders.

Thus in six years the reserve army would be complete, including reserves and the Second Reserve Army in two or three years more. The national guard should be encouraged in every way, but should be state troops and should not be paid by the federal government. As to the cost, the initial outlay would be large and should be met by a bond issue. In the long run, however, the relative cost of this plan would be less than for a paid militia of equal strength.

SOME ADVANTAGES OF THE PROPOSED RESERVE ARMY

1—Exclusively a national force.

2—Costs less than a paid national guard or regular army of equal strength.

3—It takes relatively few men permanently from productive occupations.

4—It takes men when their civil pursuits are least interfered with. Most would serve during school vacations.

5—The men are all young and are taken when they can learn the work with the least effort.

6—After three years with the colors the men are not called out except in serious danger.

7—It furnishes a force that can be mobilized quickly and without disorder.

8—The troops would be commanded by competent officers, tried out and selected in peace.

9—The force would have uniform instruction and training, and the higher officers would know their commands.

10—Such a force would enable the General Staff to formulate correct plans—they would know what forces to depend on and when they could be mobilized.

11—Two hundred thousand trained men would be turned out each year.

12—The regular army would be improved, for to be attached to a reserve division would be an honor and officers would strive to show their fitness for such a detail.

13—Even if we never have a war, this plan will benefit the country in helping some of our young men, and in case of war it will avoid the useless sacrifice of thousands of young men thru the ignorance of military amateurs in high command.

[National Guard Units in Many States Called into Federal Service. *Official Bulletin*, July 10, '17. Quoted.]

BY THE PRESIDENT OF THE UNITED STATES OF AMERICA

A Proclamation

Whereas, the United States of America and the Imperial German Government are now at war, and having in view the consequent danger of aggression by a foreign enemy upon the territory of the United States and the necessity for proper protection against possible interference with the execution of the laws of the Union by agents of the enemy, I, Woodrow Wilson, President of the United States, by virtue of the au-

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thority vested in me by the Constitution and the laws of the United States and thru the Governors of the respective States, call into the service of the United States as of and from the dates hereinafter respectively indicated all members of the National Guard and all enlisted members of the National Guard Reserve of the following States, who are not now in the service of the United States, except members of staff corps and departments not included in the personnel of tactical organizations, and except such officers of the National Guard as have been or may be specially notified by my authority that they will not be affected by this call, to wit:

On July 15, 1917, New York, Pennsylvania, Ohio, West Virginia, Michigan, Wisconsin, Minnesota, Iowa, North Dakota, South Dakota, and Nebraska.

On July 25, 1917, Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New Jersey, Delaware, Maryland, District of Columbia, Virginia, North Carolina, South Carolina, Tennessee, Illinois, Montana, Wyoming, Idaho, Washington, and Oregon.

The members of the National Guard of the various States affected by this call will be concentrated at such places as may be designated by the War Department.

II. And, under the authority conferred upon me by clause 2 of section 1 of the act of Congress "to authorize the President to increase temporarily the Military Establishment of the United States," approved May 18, 1917, I do hereby draft into the military service of the United States as of and from the 5th day of August, 1917, all members of the National Guard and all enlisted members of the National Guard Reserve of the following States, except members of staff corps and departments not included in the personnel of tactical organizations, and except such other officers of the National Guard as have been or may be specially notified by my authority that they will not be drafted, to wit:

New York, Pennsylvania, Ohio, West Virginia, Michigan, Wisconsin, Minnesota, Iowa, North Dakota, South Dakota, Nebraska, Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New Jersey, Delaware, Maryland, District of Columbia, Virginia, North Carolina, South Carolina, Tennessee, Illinois, Montana, Idaho, Washington, Oregon, Indiana, Kentucky, Georgia, Florida, Alabama, Mississippi, Arkansas, Louisiana, Oklahoma, Texas, Missouri, Kansas, Colorado, New Mexico, Arizona, Utah, California, and Wyoming.

III. All persons hereby drafted shall on and after the 5th day of August, 1917, stand discharged from the militia, and, under the terms of section 2 of the act of May 18, 1917, be subject to the laws and regulations governing the Regular Army, except as to promotions, so far as such laws and regulations are applicable to persons whose permanent retention in the military service on the active or retired list is not contemplated by law.

IV. The members of each company, battalion, regiment, brigade, division, or other organizations of the National Guard hereby drafted into the military service of the United States shall be embodied in organizations corresponding to those of the Regular Army. The officers not above the rank of colonel of said organizations of the National Guard who are drafted and whose offices are provided for in like organizations of the Regular Army are hereby appointed officers in the Army of the United States in the arm, staff, corps, or department, and in the grades in which they now hold commission as officers of the National Guard, such appointments to be effective, subject to acceptance, on and from the 5th day of August, 1917, and each of them, subject to such acceptance, is hereby assigned as of said date to the organization in the Army of the United States composed of those who were members of the organization of the National Guard in which at the time of draft he held a commission. The noncommissioned officers of the organizations of the National Guard the members of which are hereby drafted are hereby appointed noncommissioned officers in their present grade in the organizations of the Army composed of said members and shall in each case have the same relative rank as heretofore; and all other enlisted men are hereby confirmed in the Army of the United States in the grades and ratings held by them in the National Guard in all cases where such grades and ratings correspond to grades and ratings provided for in like organizations of the Regular Army, all such appointments of noncommissioned officers and confirmations of other enlisted men in their grades to be without prejudice to the authority of subordinate commanders in respect of promotions, reductions, and changes in enlisted personnel.

V. Each organization of the military force hereby created will, until further orders, bear the same name and designation as the former organization of the National Guard of whose members it is composed.

VI. All necessary orders for combining the organizations created by embodying therein members of the National Guard and National Guard Reserve hereby drafted into the military service of the United States into complete tactical units will be issued by the War Department.

In witness whereof I have hereunto set my hand and caused the seal of the United States to be affixed.

Done at the city of Washington this 3d day of July in the year of our Lord 1917 and of the Independence of the United States of America the one hundred and forty-first.

[SEAL] WOODROW WILSON.

By the President:

ROBERT LANSING,

Secretary of State.

[The Call of the National Guard. Editorial. *Army & Navy Jour.*, July 14, '17. 1200 words.]

In drafting the National Guard into the Federal service "as of and from the 5th of August, 1917," and including all officers of the Guard "not above the rank of Colonel," the dual oath required on the border mobilization is avoided and a step is made toward the exclusion of the political general.

The importance of the National Guard is indicated by its total strength of slightly over 300,000 on June 30, of whom approximately 10,000 are officers.

The nation is fortunate in having the National Guard. Despite criticisms and even admitting shortcomings, these citizen soldiers have done the best they could under hard conditions, and marked efficiency has been shown by many organizations. There will be many recruits, as is the case in the regular army, but there will be a strong percentage of seasoned officers and men, and they have already a large portion of their equipment. The service of the Guard on the border and in guarding important points since war was declared are valuable elements in their training and experience.

[Outline of a Plan for Effecting Universal Military Training in the United States. (Honorable Mention Essay.) By Col. Stephen M. Foote, U. S. Artillery Corps. *Jour. Mil. Service Inst.*, July-Aug, '17. 5200 words.]

(The article is self-summarized as follows):

Résumé:

UNIVERSAL MILITARY TRAINING

OBJECT IN VIEW

To provide a *large trained reserve* from which any desired military force may be drawn whenever needed.

LEGISLATION

Under the express constitutional grant "to raise and support armies."

1. Provide for enrolling annually, to take effect the sixteenth of June, every youth who has attained his seventeenth birthday since the fifteenth of June of the preceding year.
2. Provide for intensive field training of all those enrolled, and not exempted for physical or other reasons, for three months each summer for four successive years.
3. Create a new bureau of the War Department, similar to the Militia Bureau, to handle all matters pertaining to the reserve.
4. Add 445 field officers and 445 captains to the Regular Army for the purpose of furnishing a commanding officer and supply officer in each Congressional District or its equivalent.
5. Make appropriations for arms, equipments, offices, storehouses and training grounds.

EXECUTION OF THE LAW

1. Form the bereau and put it into operation as soon as practicable.
2. Detail officers of the Regular Army for the different districts, and send them into their districts as soon as possible.
3. Require the enrollment to be made as soon as possible—to take effect June 16th—the physical examinations to be made and exemptions determined before the tenth of June.
4. Fix upon a headquarters, supply depot and training ground for each district.
5. Secure the necessary arms, equipments, camp equipage, and so forth, for the first encampment.
6. Secure for each regiment the field officers from the Regular Army; captains and lieutenants from the Organized Militia, reserve officers and Reserve Officers' Training Corps.
7. Secure non-commissioned officers, cooks and musicians from the Regular Army, Organized Militia and Reserve Officers' Training Corps.
8. All officers and enlisted men for the camps to report for duty on June 10th.
9. All those enrolled, unless specially exempted, to report at the designated rendezvous on June 16th.
10. Camps will be broken on the 15th of September, and all except the commanding officer, supply officer and sufficient enlisted men to care for the property sent away.
11. Plans will be perfected in each Congressional District for the next encampment, the class for the following year enrolled, and preparations made to handle two classes at the next encampment. An effort will be made to secure as many non-commissioned officers as possible out of the class that has taken its first year's training.
12. The third and fourth encampments will be similarly held.
13. After having served thru four training periods, the reservist should not be called upon for further training service in time of peace, but will be held thereafter liable to active service whenever called upon pursuant to special Congressional enactments for the purpose.

—Army—Sanitary Service

[Civil Physicians and National Defense. By Lt.-Col. Henry Page, M. C., U. S. A. *The Military Surgeon*, Apr, '17. 2700 words.]

(An article discussing the lack of trained men for the military medical service. At the date of writing, there were in the reserve "barely enough men to reenforce the regular army and the militia on the border.")

[Physical Examination of Large Bodies of Men. By Col. Charles Willcox, M. C., U. S. A. *The Military Surgeon*, Apr, '17. 3500 words.]

(Discussion and recommendation of a method of examining men in large numbers, that has been shown by experience to be rapid, thoro, and satisfactory.)

[Our Resources in Medical Personnel. *The Military Surgeon*, Apr, '17. 650 words.]

The civil profession must be prepared to furnish 7000 physicians at once, and 3000 for emergencies, per million of troops. In the event of war, outside help will probably not be necessary. But we shall need all the medical men we have to meet the demands of both the civil and military communities.

[Base Hospitals for France. *Army & Navy Jour.*, May 12, '17. 300 words.]

The six base hospitals of the Army, organized for service in France by the American Red Cross under direction of the Medical Corps, U. S. A., have been rapidly equipped and made ready for service. Each

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base hospital consists of two medical officers of the Army, 65 nurses and 153 enlisted men, taken from the Regular Army and the American Red Cross.

[Note. *Army & Navy Jour.*, July 21, '17. 200 words.]

It is computed that there are approximately 20,000 physicians in the United States of such ages as to be subject to draft.

[32 Hospitals at . . . Camps. . . . *Official Bulletin*, Aug 2, '17. Quoted.]

The War Department authorizes the following:

Provisions for caring for the health of the soldiers now being made by the Medical Department of the Army include the construction of 32 hospitals at National Army and National Guard camps, the enlargement of some 30 hospitals used in connection with officers' training camps, taking over or construction of at least two general hospitals at ports, increasing the size of two other general hospitals behind these, and the building or taking over of a number of general hospitals to be used for special treatment work. Plans for this phase of the work are not complete. Efforts are being made to secure hospital buildings ready built, but some will probably have to be constructed. A number of sites have been offered already.

A further step to be worked out is the provision of reconstruction hospitals, where artificial limbs will be made, repair surgery done, artificial limbs fitted to patients, and re-education of cripples begun, to enable them to use the artificial limbs provided and again become useful members of society.

Will Provide for Large Number

The aim of the Medical Department is to have hospital provisions for 5 per cent of the enlisted force by fall, and then to proceed to extend that to 10 per cent. Abroad facilities for 20 per cent of the American expeditionary forces will be provided.

At cantonments hospital provision will be made for 3 per cent of the troops at each camp. A complete modern hospital will be constructed at each, containing at least 1000 beds. With the space reserved for extensions, each hospital and its auxiliary buildings will require 60 acres. This allotment will leave generous space between the various buildings of each hospital. Hospitals at National Army camps will cost approximately $500,000 each, and at National Guard camps, where heating is not required, construction is lighter and sewer-connected plumbing not to be used, about $400,000. This will bring the total cost of the 32 hospitals to about $14,500,000. Each hospital will have equipment equal to that of the best institutions in the country, altho the construction of the buildings will be of much cheaper quality.

One Type of Construction

One type is being used in all the hospital construction work done by the Army. All the buildings are 24 feet wide, the length varying to meet the needs. The wards are usually 157 feet long, which is the size needed for 32 beds. There will be a diet kitchen for each ward, a porch on one side and end of each ward, and a corridor connecting with the buildings on either side which will be covered in the case of the northern cantonments.

About 70 buildings will be comprised in each cantonment hospital on the 1000-bed basis. In some cases two wards are joined, thus reducing the actual number of separate buildings, but the number of buildings will reach about 70, counting each ward as a building.

Each hospital will have a well-equipped laboratory where bacteriological and pathological work can be done which any well-equipped hospital could handle. Some special blood tests will be made at the department hospitals, which will take care of any work that the divisional hospitals at the camps cannot attend to.

There will also be an infirmary for each regiment which will fulfill the functions usually performed by such institutions. There men not needing to be confined in hospital will report when any condition appears which demands watching. There vaccination will be done and the typhoid and paratyphoid preventative treatments administered.

—Army—Signal Corps

See also

AERONAUTICS—UNITED STATES

MOTOR TRANSPORT—UNITED STATES (Article: "Two Sizes of Standardized Signal Corps Trucks")

—Army—Staff

[Increase in the General Staff Corps. Editorial. *Army & Navy Jour.*, Jan 6, '17. 900 words.]

The sections of the National Defense act affecting the General Staff and the National Guard as a federal force need revision.

Both the Secretary of War and the Chief of Staff have set forth the needs of the General Staff in their annual reports. The chief difficulties are that the General Staff is too small and that only one half of it can be stationed in Washington. This leaves entirely too few officers to handle the work of preparing the country against the emergency of war. The General Staff has now to devise a plan of universal military service. An increase to a strength of 92 officers and repeal of the provision regarding station in Washington are recommended by the Chief of Staff.

[Quartermaster Officers Soon to Have Training Camp. *Official Bulletin*, Aug 2, '17. Quoted.]

A Quartermaster's Corps training camp is soon to be established. About 3200 officers from the officers' training camps now in operation will be sent to the new camp for additional training in work for the Quartermaster's Corps. The camp will also accommodate from 10,000 to 20,000 enlisted men, to be formed into Quartermaster Corps units.

A staff of instructors will be required, and assistant instructors will be drawn from noncommissioned officers already in the service.

The camp will be used for the formation of special and technical units such as motor companies, wagon

companies, stevedore regiments, labor companies, supply companies, repair shops, salvage shops, etc.

The camp buildings will follow the cantonment plans with such variations as special work will call for.

Several sites are under consideration and announcement of choice will probably be made soon. A tract of something like 2000 acres will be required.

The office of the Quartermaster General states that no applications for appointment to the Quartermaster's Reserve Corps made since April 12 are being considered. Only those sent from the officers' training camps are eligible to become student officers at the Quartermaster's Corps training camp.

—Army—Supply and Transport

See also

MOTOR TRANSPORT—UNITED STATES

RAILROADS

RAILROADS—ROLLING STOCK

SUPPLY AND TRANSPORT—UNITED STATES

—Coast Defense

[Project for Coast Defenses. By Capt. S. D. Embick, C. A. C. *Jour. U. S. Artill.*, Sept-Oct, '16. 7000 words.]

In approaching the problem of our national defense, one is impressed both with the magnitude of the interests to be defended, and with the wide extent of our frontiers exposed to attack. In a military sense, the United States occupies an insular position, and the absence of a strong military power in the western hemisphere precludes an attack in force, except from oversea.

In consequence of our insular position, it may be stated broadly that the navy constitutes the first line of defense. But to enable the fleet to accomplish its mission of securing control of the sea, it must be concentrated and must be free to seek out the enemy's fleet on the high seas. It will be free so to operate only when the coasts are protected by fortifications and land forces against raids by the enemy.

The purposes to be accomplished by seacoast fortifications may be summarized by saying that they protect important coast points against naval attack; they prevent occupation by an enemy of important strategic harbors; they free the fleet for offensive action; they afford it secure bases in which to refit; and they may permit the fleet to defer for a time a decisive engagement and thus gain time for the development of latent military resources.

The provision of fixed seacoast fortification has been limited to harbors deemed of greatest commercial and strategic importance. The provision of seacoast fortifications covering the entire coast line is obviously impracticable, and the defense of the intervening stretches is the function of the mobile army. If the United States possesses a strong mobile army, the invader can be met and defeated at the beach, but without such an army an invader can overrun large sections of the country in less time than would be required for the development of our latent military resources. One of the developments of the present European war is the introduction of large-caliber movable armament. Such artillery can be of great assistance to the mobile army defending the coast line. The sections of our coast line most important strategically already are paralleled by coastal railways, over which such artillery can be moved.

Naval operations against our coasts may include blockade, bombardment, deliberate attack, or run-by.

Blockade may be either a war or a commercial blockade, but the advent of the submarine has rendered a close blockade an exceedingly difficult operation. Only in a close blockade would the coast defenses come into action.

Bombardments may be undertaken to destroy the fortifications or to damage the utilities protected by them. Fortifications, in the past, have suffered but little from naval bombardments, but the case is different in the wide target presented by a compactly built city.

The deliberate attack may be naval or combined land and naval, the latter being the form most likely to occur. A direct naval attack may take the form of:

(a) Reconnaissance and attack of mine fields.
(b) Reconnaissance of batteries.
(c) Attempt at run-by.

The reconnaissance and attack of the mine fields probably would be the first phase of a general attack, and would be carried out by small ships. The location of most of our batteries is well known, particularly those in the United States, so little reconnaissance of the batteries is necessary except possibly to determine the result of a bombardment. The possibility of a run-by will be influenced by local conditions, but it may be expected if the enemy controls the sea, and the object in view justifies the probable loss of ships. Raids by destroyers and submarines would seem to be the most likely form of attack to which our coasts will be exposed, and our well-known unreadiness is an invitation to this form of attack.

The several elements employed in seacoast defenses include guns and mortars and their accessories, mines, submarines, picket, and patrol boats, and airplanes.

The rapid progress in naval design during the past decade has included not only a material increase in the size and resisting powers of ships, but an increase in the size of naval ordnance. The 14-inch gun may be regarded as the general standard now, but some navies have gone to the 15-inch, and we may see the 16-inch generally adopted in the near future. These guns have ranges from 21,000 to 25,000 yards.

In view of these developments of naval design, there would appear to be no reason why the primary gun on a fixed mount in our coast defenses should be less than 16 inches in caliber. The controlling consideration in selecting a primary gun for coast defenses is that it shall deliver such a blow as to inflict material if not irreparable damage upon a hostile battleship to which opposed. The 16-inch, 50-caliber gun seems to meet present requirements, with a small margin for future developments. The mount should afford all-round fire and a permissible elevation of 30 degrees, giving a maximum range of about 40,000 yards by the use of auxiliary base lines.

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For the small, fast craft, a gun combining high rate of fire with stopping power is required. The 6-inch gun, which is the largest that can be handled as a rapid-fire gun, is one which best meets these requirements.

Seacoast mortars possess many advantages as well as disadvantages, one of the latter being the necessity of employing projectiles of two weights with the present 12-inch mortar. By increasing the caliber to 16 inches, one type of projectile of 1660 lbs. will cover all zones from 3000 to 23,000 yards, and will have ample perforating and destructive effect in all zones.

Anti-aircraft guns also are needed.

The selection of sites for the armament is influenced by more or less conflicting general considerations, and by local conditions as well. The general considerations include:

(a) The armament should be sufficiently far advanced to prevent damage to the utilities it defends by naval bombardment from areas beyond the range of the armament.

(b) A maximum sector of deep water must be covered at effective ranges.

(c) The vessels of our own fleet should be protected when debouching in column from the harbor.

(d) Isolation of batteries should be avoided to prevent reduction in detail.

(e) The armament should be dispersed to preclude an effective concentration of hostile fire thereon.

(f) The sites should favor concealment.

(g) They should be capable of being securely held against landing parties by use of a small infantry force.

(h) Effective fire control and searchlight systems should be possible.

In addition, for mortars, the main channel of approach should traverse the minimum number of zones.

No general rule establishing the ratio of guns ashore to those in the naval attacking force is satisfactory. Too many local conditions enter the problem. It must be solved locally.

Due to the great ranges attained at present, fire control is of the greatest importance. Base lines for long-range work should be about 4000 yards in length, the stations should be small and inconspicuous, and several emergency stations should be provided on each base line.

The 60-inch searchlight has been adopted as the standard light. The proper location of these lights is a local problem and is determined by experiment on the ground. The following considerations should be fulfilled if practicable.

(a) Searching lights should be well in advance and cover all avenues of approach.

(b) Illuminating lights should be on the flanks of all elements they are to serve.

(c) Illuminating lights should have at least 150 yards lateral and 20 feet vertical displacement from the nearest element they serve.

(d) While illuminating lights should be higher than the elements they serve, they should not be mounted on conspicuous structures.

Submarine mines are needed to preclude a run-by during weather unfavorable to the gun defenses. The field must be covered effectively by gun fire and must be illuminated by searchlight at night. An observance of this principle places the mine field within about 4000 yards of the defenses. To preclude danger to friendly shipping, the mines must be the anchored, shore-controlled type.

The most effective defense for preventing run-past into interior waters by destroyers is some form of boom, which must be supplemented by some form of net in waters suitable for the employment of submarines.

[Work on Canal Zone Defenses. *Army & Navy Jour.*, Mar 3, '17. 200 words.]

Both the War and Navy Departments are hastening plans for the defense of the Canal Zone. The work on fortifications is being quickened. Also eight anti-aircraft guns are to be installed at exposed strategic points at the earliest possible time. A more elaborate submarine base has been authorized at either Colon or Panama. The C boats stationed there will be reinforced by 7 N boats and some O boats.

—Coast Defense—Use of Aircraft in

[Developing Our Coast Patrol. *Army & Navy Jour.*, Mar 17, '17. 250 words.]

500 vessels and 10,000 men are needed for adequate patrol of the Third Naval District extending from New London, Conn., to Barnegat, N. J. Naval officers in charge of the enrollment in the Coast Defense Reserve Corps expect the force to be available when needed. Vessels of every type are being registered, many of which will be used as submarine chasers. The British have found that boats driven by a slow turning engine are best suited for submarine chasers, because the propellers of high speed boats cause such a disturbance and noise in the water that submarines are warned by their detectors of the patrol boat's approach.

[Note. *Army & Navy Jour.*, Mar 3, '17. 85 words.]

San Diego, Cal., has been selected by the War Department as the first city on the Pacific Coast to be equipped with a squadron of battleplanes and seaplanes to act as scouts for the port's defense. The company will comprise twelve seaplanes and three pursuit triplanes, all fitted with machine guns and bomb-dropping devices. The personnel will consist of sixteen aviators and 160 mechanicians, bomb-throwers and radio operators.

[Air Defense for Our Coasts. *Army & Navy Jour.*, Mar 17, '17. 1300 words.]

According to present plans, there will be established at least eight aeronautical bases on the Atlantic and Gulf coasts as auxiliaries to the coast defense fortifications. The personnel of each base will consist of six officers and 40 men, and the equipment will consist of two dirigibles, six or eight seaplanes and several 110-foot

coast patrol launches. The only site definitely selected is at Coco Solo, near Colon, Canal Zone. At present no aeronautical bases are planned for the Pacific, but air squadrons will be used in connection with the coast defenses.

The Navy Department has awarded contracts for sixteen dirigibles, deliveries of which are to begin in 120 days. The dirigibles are to measure 160 feet in length, 31½ feet in diameter, or 50 feet over all, and will be capable of sustained flight for ten hours at a maximum speed of forty-five miles per hour. They are designed to operate from shore bases, but may alight on the water.

—Food and Commodity Prices and Supply

[Munitions, Food and Labor Preparedness. *Army & Navy Jour.*, Apr 14, '17. 900 words.]

The Council of National Defense has created a General Munitions Board and a Food Board. The former will co-ordinate the purchases of the army and navy and assist in the acquirement of raw materials and manufacturing facilities. The creation of this board is viewed as a possible initial step toward the creation of a Ministry of Munitions. The president of American organized labor has pledged that organization to a full and loyal support of the government in the war with Germany.

—Geological Survey

See also

MAPS AND MAPPING—UNITED STATES

—History

See also

AMERICAN REVOLUTION
CIVIL WAR—UNITED STATES
DONIPHAN EXPEDITION (1847)
EUROPEAN WAR
MEXICAN BORDER MOBILIZATION (1915-17)
MEXICAN WAR (WITH U. S.)

[The Question of America. Contemporary Public Opinion, 1765-1775. By Katherine F. Doughty. *United Service Magazine*, April, '17. 5600 words.]

(Historical.)

[The United States and War: A Retrospect. By T. Miller Maguire, F.R. Hist. Soc., LL.D. *United Service Magazine*, April, '17. 4000 words.]

(Historical article, including a general discussion of the period of 1756-1763, the Naval War of 1812 sea power and the United States, the ruin of the Red Indians, Texas and Mexico, and the War of Secession, 1861-1865. It summarizes thus):

"It is manifest that neither their internal union nor their expansion from thirteen original States in 1783 to more than fifty States and territories now, nor that any of their foreign possessions were due to pacific persuasions. They owe their greatness and its preservation to navies and armies—to the naked sword; by such methods their superficial area has reached a total of about 3,200,000 square miles, and their population has expanded from 4,000,000 in 1790 to about 91,000,000, now.

—Military Conditions

See also

PANAMA CANAL

[Military Man Power of the United States. *Scientific American*, Dec 16, '16. 700 words.]

The Bureau of Census has given some data on the number of men of military age in the United States. In 1910, the total number of male citizens and prospective citizens of ages 18 to 45 was 14,224,000 native whites, 2,857,000 foreign born whites, 2,052,000 negroes, and 50,000 Indians, a total of 19,183,000. There were in addition 1,796,000 alien whites and 92,000 other aliens.

Since 1910, the natural increase is estimated to be about equal to the total aliens in 1910, so that there are now roughly 21,000,000 citizens and prospective citizens of ages 18 to 45. New York has 2,223,633; Pennsylvania, 1,842,266; Illinois, 1,369,910; and Ohio, 1,107,888. By groups of states, there are 13,000,000 in the northern states, 6,000,000 in the southern states, and 2,000,000 in the western states.

The commonly accepted military estimate of men suitable for military service is 10 per cent. of the population. It is believed that Germany has succeeded in producing 13 per cent. of first class effectives out of a population of 70,000,000.

—Military Policy of

See also

EDUCATION, MILITARY—IN SCHOOLS AND COLLEGES
MONROE DOCTRINE
PREPAREDNESS FOR WAR—MOBILIZATION OF NATIONAL RESOURCES—UNITED STATES
UNITED STATES—NAVAL POLICY OF
EDUCATION, MILITARY—IN SCHOOLS AND COLLEGES
NATIONAL ARMY (UNITED STATES)

[What Have We Learned? By Major Richard Stockton, O.R.C. G. M. Prize Essay. *Jour. Military Service Inst. U. S.* 5000 words.]

With all our examples and experience of the past five years—the European War, incessant troubles in and about Mexico, and minor interferences in Central America and the West Indies—what have we the people of America, learned? This—that our present system of providing an army, navy, and citizen soldiery, is militarily, economically, and politically incorrect and basically unsound; and hence cannot possibly produce a satisfactory solution of the problem of providing adequate national defense.

First, it cannot provide the necessary men for either regular or citizen soldier services. The Regular Army, recruited from volunteers, cannot reach adequate strength. If the Guard mobilization does not demonstrate the fallacy of the system, Europe of today should; for we must be convinced that no citizen soldiery that has been without a continuous period of intensive training for at least a year can possibly fill a place in the first line.

Of the 133,256 National Guardsmen in the Federal Service, Aug 31, 1916, 42 per cent were raw recruits, 38 per cent of the remainder had been in the Guard for less than a year, only 24 per cent had attended

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half of the prescribed number of drills. and only 6& per cent had attended the annual encampments. In regard to matériel, on Aug 24, 1916, of a total of some 70,000 horses and mules required, but 36,000 had been issued; of 21,000 horses needed for field artillery, but 7000 had been secured. In September, men were still without complete uniforms and equipment. In addition, there was little evidence of the knowledge of discipline displayed by any of the Guard officers. From the experience on the border and the recruiting at home, is there any promise that the Guard can increase itself by voluntarily enlistments from 130,000 to 457,000 men as the Defense Act requires? The Army itself has never found the method satisfactory.

78 per cent of the men in the Guard lost all pay in civil life while responding to the call. Of certain firms represented, comprising 1,025,000 employees, only 7858 were enlisted in the Guard; or seven-tenths of 1 per cent were allowed to bear the hardships of the whole.

The average earnings of this minority were $900 a year. If that was its productive capacity, the United States was losing $119,700,000 annually. For a youth of nineteen the average is $250 a year. The productive loss in the latter case would have been $36,575,000. If the force on the border had consisted of one million instead of 100,000, the loss on the present system would have been $1,197,000,000 annually, whereas for youths of nineteen, the loss would be $365,750,000—a saving in the latter case of over eight hundred million.

The great faults of our present military system are: that it does not provide the necessary men for either regular or citizen soldier services; that it does not provide the class of men who can give the time for training which is necessary for proper results in citizen soldiery; that it does not permit the practice for our officers of handling large bodies of troops in the field; that it takes the men from civil life who are needed therein in time of national emergency, and fails to compel the service of those who have no responsibilities and who should serve; and that it throws the burden of defense upon a few men instead of dividing it according to prearranged plans in keeping with the principles of democracy.

[The Triumph of Upton's Preaching. *Army & Navy Jour.*, May 5, '17. 700 words.]

By the publication in 1904 of "A Military Policy of the United States," General Emory Upton became the primary cause of a change in the national consciousness concerning military principles, making possible the passage on Apr 28, 1917, by Congress of the universal military service law. His extraordinary vision and superb grasp of military principles have impressed themselves upon all his readers, who have steadily grown in number.

[Initial Strategy on Our North Atlantic Frontier—A Study in the Preparation of War Plans to Meet Certain Conditions. By Capt. Howard L. Landers, 7th F. A., U. S. Army. *Jour. U. S. Artill.*, May-June, '17. 9200 words.]

In our army at present there is a lack of co-ordination in methods of instruction and a failure to realize that the training of an officer for higher command must be on the broadest lines possible. At all service schools and at the War College, the courses should be broadened. Coast artillery officers should be given a better idea of co-operation with mobile forces and line officers should be more familiar with coast artillery methods and the strategy of naval-coast defense warfare.

Local defense plans for the various coast defenses have been formulated and are important, but they must co-ordinate with the particular centralized war plan that our national strategists may determine to use.

To formulate correct war plans Congress should create a War Council which will be permanent and therefore not swayed in decisions by sectional demands. It must take what it finds in the way of military strength and concentrate our forces for the defense of that sector which we can least afford to lose.

[Here follows a plan for the defense of the North Atlantic Coast based on our military strength at the beginning of the present war. Not susceptible of ready condensation.—Ed.]

An army of a million men of fifteen months training is necessary to safeguard the Atlantic and Gulf frontiers. Defense against a coalition of eastern and western nations would require an additional half million men for the Pacific Coast. A million and a half second line troops should be concentrated in the Middle West to complete their training.

Our frontier should be our coast line. To effect this, our present harbor defenses must be connected by providing heavy mobile guns. These should be powerful enough to anticipate development on similar lines by hostile navies and their carriages should be capable of operation on rails or an highways. No more harbor defense armament should be permanently emplaced. except 16-inch guns and mortars. All other armament should be positioned only, thereby preserving its mobility and giving it the active rôle of an offensive weapon.

—Military Policy of—Compulsory Military Service

[Shall We Adopt Universal Military Service? By Charles W. Eliot (President Emeritus of Harvard University). *World's Work*, Nov, '16. 4500 words.]

(The author discusses the subject under the following sub-heads: America no longer isolated; if we had universal service; moral advantages of strength; our duty toward world peace; regenerated Russia; the Navy; imperfections of the militia; for a democratic army; the fallacy of non-resistance; force must still control; fitting men to their tasks; changes in schooling; the Swiss military system; safety without militarism; America's military needs; a grave but necessary choice; facing the facts.

The trend of the discussion is indicated in a general way by the headings. The author concludes that—)

"The United States needs a navy modeled on the British navy and an army modeled on the Swiss army; and in order to procure both it needs to adopt the principle of brief universal service in the army or the navy."

[Opinions of Scott and Wood and Baker. *Army & Navy Jour.*, Dec 23, '16. 3000 words.]

In a hearing before the Senate Committee on Naval (?) Affairs, Gen. Scott, Chief of Staff, criticized the militia system, presenting a table showing that of the present effective strength of 119,874, there were about 60,000 without prior service, about 71,000 with no field service, and about 57,000 who had never fired before the call. France requires 8014 hours of training for troops of all arms; Germany 8532 hours for mounted troops and 5832 hours for all other troops. Latest information is that England requires eleven months of training before troops are allowed to go into the advanced trenches. The National Guard has 192 hours of training annually. The Chief of Staff estimated that we needed 1,500,000 fully equipped troops and a like additional number ready in 90 days. No volunteer system will produce these numbers, and Gen. Scott argued in favor of universal liability for military service.

The Secretary of War said that the mobilization had developed the National Guard, and that the whole experience was very encouraging. He declined to commit himself respecting compulsory military service. He stated that there were plenty of arms and ammunition in this country for 1,000,000 men for a year's campaign, and more could be manufactured quickly if modern factory equipment was maintained.

Gen. Wood argued in favor of universal military service as the only really democratic system. He advocated a system providing for six months intensive training at 19, followed by thirty days at 21, when the young man would be enrolled in a "national reserve" regiment until he was 29 years of age. Gen. Wood opposed payment for this service.

•[Some Reflections Upon our Military Experiment of 1916. By Henry L. Stimson. *National Service*, Apr, '17. 4700 words.]

A year ago Congress decided to raise a national citizen army, the command of which was to be divided between federal and state authorities, contrary to the warnings of the then Secretary of War and others who had made a close study of the matter. The militia pay provision and the voices of the higher officers of the National Guard, not of the enlisted men and junior officers, decided them. The President yielded and Mr. Garrison resigned.

Normally, the ultimate placing of 800 federal-paid militia men in each Congressional district and the consequent development of a powerful political machine would have been overlooked. But the concentration, last summer, forced by the Mexican situation, brought to light vividly the serious shortcomings of the system adopted.

In order to fully comprehend the figures compiled by the War Department concerning this mobilization, the following must be taken into consideration. The minimum number of fully trained men needed to meet an invasion has been set at 500,000 by the General Staff of the army. Also, any one of at least three European nations could land a complete expeditionary force of at least 150,000 men on our Atlantic coast in about two weeks' time; and one Oriental nation on our Pacific coast in three weeks.

On the 18th the President called for units at war strength. On Aug 31 the units called had only 138,500 instead of the war strength—252,000 men. This after zealous efforts at recruiting in a year of unusual interest in military affairs. Sixty per cent of this number were raw recruits. Fifty per cent of the originally enrolled members failed to pass into the federal service for various reasons. Field inspections of 123,000 showed 50,000 had had no rifle-range instruction before the call; the marksmanship of 19,000 was rated "barely tolerable" by the Chief of Staff of the Army; 71,000 had never attended an encampment nor received any field training. Only 37 per cent had received more than three months' indoor instruction. The mobilization was a fair test, as the militia system is not new. The individual men are not to be blamed, as the fault lies in the system.

In general, there are three alternatives for the system which has failed:

1. By voluntary training.
2. By selective training.
3. By universal training.

The volunteer system has become obsolete, because the modern war has reached such gigantic dimensions that sufficient volunteers cannot be obtained, and because of the unfairness of such a system.

Selective training will not answer, as the duration of any war cannot be predicted with any certainty, it fails as a preventive of war, and it does not benefit the citizenship at large.

Universal training only will answer. The American nation has become a city-dwelling people, unfitted for the hardships of campaigning, and with the rapid influx of a foreign-born element into our population our national institutions are in danger. Universal training will not only give us a national defense, but will benefit our youths physically and give them a proper appreciation of the institutions built up and maintained at such cost to our forefathers. It is the only true basis on which a democracy can rest.

This training should be out of doors in a single period of about six months, under officers of the regular army. 500,000 youths can be trained each year for less than half the cost of last summer's mobilization.

[Emergency Army Bill. *Army & Navy Jour.*, May 19, '17. 4200 words. Quoted.]

(Following is the full text of the Emergency Army Bill, signed by the President on May 18, 1917.)

H. R. 3545.—For temporary increase in the military establishment of the United States.

COMPOSITION OF THE ARMY

Be it enacted, etc., That in view of the existing

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emergency, which demands the raising of troops in addition to those now available, the President be, and he is hereby, authorized—

First. Immediately to raise, organize, officer and equip all or such number of increments of Regular Army provided by National Defense Act approved June 3, 1916, or such parts thereof as he may deem necessary; to raise all organizations of Regular Army, including those added by such increments, to maximum enlisted strength authorized by law. Vacancies in Regular Army created or caused by addition of increments as herein authorized which cannot be filled by promotion may be filled by temporary appointment for period of emergency or until replaced by permanent appointments or by provisional appointments made under provision of Sec. 23 of National Defense Act of June 3, 1916, and hereafter provisional appointments under said section may be terminated whenever it is determined, in manner prescribed by President, that the officer has not suitability and fitness requisite for permanent appointment.

Second. To draft into military service of U. S., organize and officer, in accordance with provisions of Sec. 111 of said National Defense Act, so far as provisions of said section may be applicable and not inconsistent with terms of this act, any or all members of National Guard and of N. G. Reserves, and said members so drafted into military service of U. S. shall serve therein for period of existing emergency unless sooner discharged: Provided, That when so drafted the organizations or units of N. G. shall, so far as practicable, retain the state designations of their respective organizations.

Third. To raise by draft as herein provided, organize and equip an additional force of 500,000 enlisted men, or such part or parts thereof as he may at any time deem necessary, and to provide necessary officers, line and staff, for said force and for organizations of other forces hereby authorized, or by combining organizations of said other forces, by ordering members of Officers' Reserve Corps to temporary duty in accordance with provisions of Sec. 38 of the National Defense Act of June 3, 1916; by appointment from Regular Army, the Officers' Reserve Corps, from those duly qualified and registered pursuant to Sec. 23, Act of Jan 21, 1903, from members of National Guard drafted into service of U. S., from those who have been graduated from educational institutions at which military instruction is compulsory, or from those who have had honorable service in Regular Army, National Guard, or in Volunteer forces, or from country at large; by assigning retired officers of Regular Army to active duty with such force with their rank on retired list and full pay and allowances of their grade; or by appointment of retired officers and enlisted men, active or retired, of Regular Army as commissioned officers in such forces: Provided, That organization of said force shall be same as that of corresponding organizations of Regular Army: Provided further, That the President is authorized to increase or decrease number of organizations prescribed for the typical brigades, divisions, or army corps of Regular Army, and to prescribe such new and different organizations and personnel for army corps, divisions, brigades, regiments, battalions, squadrons, companies, troops and batteries as efficiency of service may require: Provided further, That number of organizations in a regiment shall not be increased nor shall number of regiments be decreased: Provided further, That the President in his discretion may organize, officer and equip for each Infantry and Cavalry brigade three machine-gun companies, and for each Infantry and Cavalry division four machine-gun companies, all in addition to machine-gun companies comprised in organizations included in such brigades and divisions: Provided further, That the President in his discretion may organize for each division one armored motor car machine-gun company. The machine-gun companies organized under this section shall consist of such commissioned and enlisted personnel and be equipped in such manner as President may prescribe: And provided further, That officers with rank not above that of colonel shall be appointed by the President alone, and officers above that grade by the President by and with advice and consent of Senate: Provided further, That the President may in his discretion recommission in Coast Guard persons who have heretofore held commissions in Revenue Cutter Service or Coast Guard and have left the service honorably, after ascertaining that they are qualified for service physically, morally and as to age and military fitness.

Fourth. The President is further authorized, in his discretion and at such time as he may determine, to raise and begin training of an additional force of 500,000 men organized, officered and equipped, as provided for force first mentioned in preceding paragraph of this section.

Fifth. To raise by draft, organize, equip and officer, as provided in third paragraph of this section, in addition to and for each of above forces, such recruit training units as he may deem necessary for maintenance of such forces at maximum strength.

Sixth. To raise, organize, officer and maintain during emergency such number of ammunition batteries and battalions, depot batteries and battalions, and such artillery parks, with such numbers and grades of personnel as he may deem necessary. Such organizations shall be officered in manner provided in third paragraph of this section, and enlisted men may be assigned to said organizations from any of forces herein provided for or raised by selective draft as by this act provided.

FOR A VOLUNTEER DIVISION

Seventh. The President is further authorized to raise and maintain by voluntary enlistment, to organize and equip not to exceed four Infantry divisions, the officers of which shall be selected in manner provided by Par. 3 of Sec. 1 of this act: Provided, That organization of said force shall be same as that of corresponding organization of Regular Army: And provided further, That there shall be no enlistments in said force of men under twenty-five years of age at time of en-

listing: And provided further, That no such volunteer force shall be accepted in any unit smaller than a division.

VOLUNTEERING AND THE DRAFT

Sec. 2. That the enlisted men required to raise and maintain organizations of Regular Army and to complete and maintain organizations embodying members of National Guard drafted into service of U. S., at maximum legal strength as by this act provided, shall be raised by voluntary enlistment, or if and whenever President decides that they cannot effectually be so raised or maintained, then by selective draft; and all other forces hereby authorized shall be raised and maintained by selective draft exclusively; but this provision shall not prevent transfer to any force of training cadres from other forces. Such draft as herein provided shall be based upon liability to military service of all male citizens, or male persons not alien enemies who have declared their intention to become citizens, between ages of 21 and 30 years, both inclusive, and shall take place and be maintained under such regulations as President may prescribe not inconsistent with terms of this act. Quotas for the several states, territories and District of Columbia, or subdivisions thereof, shall be determined in proportion to population thereof, and credit shall be given to any state, territory, district, or subdivision thereof, for number of men who were in military service of U. S. as members of National Guard on Apr 1, 1917, or who have since said date entered military service of U. S. from any such state, territory, district, or subdivisions, either as members of Regular Army or National Guard. All persons drafted into service of U. S. and all officers accepting commissions in forces herein provided for shall, from date of said draft or acceptance, be subject to laws and regulations governing Regular Army, except as to promotions, so far as such laws and regulations are applicable to persons whose permanent retention in military service on active or retired list is not contemplated by existing law, and those drafted shall be required to serve for period of existing emergency unless sooner discharged: Provided, That President is authorized to raise and maintain by voluntary enlistment or draft, as herein provided, special and technical troops as he may deem necessary, and to embody them into organizations and to officer them as provided in third paragraph of Sec. 1 and Sec. 9 of this act. Organizations of forces herein provided for, except Regular Army, shall, as far as interests of service permit, be composed of men who come, and of officers who are appointed from, same state or locality.

BOUNTY AND SUBSTITUTES PROHIBITED

Sec. 3. No bounty shall be paid to induce any person to enlist in military service of U. S.; and no person liable to military service shall hereafter be permitted or allowed to furnish substitute for such service; nor shall any substitute be received, enlisted or enrolled in military service of U. S.; and no such person shall be permitted to escape such service or to be discharged therefrom prior to expiration of his term of service by payment of money or any other valuable thing whatsoever as consideration of his release from military service or liability thereto.

EXEMPTIONS AND PARTIAL SERVICE

Sec. 4. That the Vice-President of U. S., the officers, legislative, executive and judicial, of U. S. and of the several states, territories and District of Columbia, regular or duly ordained ministers of religion, students who at time of approval of this act are preparing for ministry in recognized theological or divinity schools, and all persons in military and naval service of U. S. shall be exempt from selective draft herein prescribed; and nothing in this act contained shall be construed to require or compel any person to serve in any of forces herein provided for who is found to be a member of any well-recognized religious sect or organization at present organized and existing and whose existing creed or principles forbid its members to participate in war in any form and whose religious convictions are against war or participation therein in accordance with creed or principles of said religious organizations, but no person so exempted shall be exempted from service in any capacity President shall declare to be non-combatant; and the President is hereby authorized to exclude or discharge from said selective draft and from draft under second paragraph of Sec. 1 hereof, or to draft for partial military service only from those liable to draft as in this act provided, persons of following classes: County and municipal officials; customhouse clerks; persons employed by U. S. in transmission of mails; artificers and workmen employed in armories, arsenals and navy yards of U. S., and such other persons employed in service of U. S. as President may designate; pilots; mariners actually employed in sea service of any citizen or merchant within U. S.; persons engaged in industries, including agriculture, found to be necessary to maintenance of Military Establishment or effective operation of military forces or maintenance of national interest during emergency; those in a status with respect to persons dependent upon them for support which renders their exclusion or discharge advisable; and those found physically or morally deficient. No exemption or exclusion shall continue when a cause therefor no longer exists: Provided, That notwithstanding exemptions enumerated herein, each state, territory and District of Columbia shall be required to supply its quota in proportion that its population bears to total population of U. S.

REGISTRATION

The President is hereby authorized, in his discretion, to create and establish thruout the several states and subdivisions thereof and in territories and District of Columbia Local Boards, and where, in his discretion, practicable and desirable, there shall be created and established one such Local Board in each county or similar subdivision in each state, and one for approximately each 30,000 of population in each city of 30,000 population or over, according to last census taken or estimates furnished by Bureau of Census of Department of Commerce. Such Boards shall be appointed by President, and shall consist of three or more mem-

UNITED STATES—Continued

bers, none of whom shall be connected with Military Establishment, to be chosen from among local authorities of such subdivisions or from other citizens residing in subdivision or area in which respective Boards will have jurisdiction under rules and regulations prescribed by President. Such Boards shall have power within their respective jurisdictions to hear and determine, subject to review as hereinafter provided, all questions of exemption under this act, and all questions of or claims for including or discharging individuals or classes of individuals from selective draft, which shall be made under rules and regulations prescribed by President, except any and every question or claim for including or excluding or discharging persons or classes of persons from selective draft under provisions of this act authorizing President to exclude or discharge from selective draft "Persons engaged in industries, including agriculture, found to be necessary to maintenance of Military Establishment, or effective operation of military forces, or maintenance of national interest during the emergency."

The President is hereby authorized to establish additional Boards, one in each Federal Judicial District of U. S., consisting of such number of citizens, not connected with Military Establishment, as President may determine, who shall be appointed by President. The President is hereby authorized, in his discretion, to establish more than one such Board in any Federal Judicial District in U. S., or to establish one such Board having jurisdiction of an area extending into more than one Federal Judicial District. Such District Boards shall review on appeal and affirm, modify or reverse any decision of any Local Board having jurisdiction in area in which any such District Board has jurisdiction under rules and regulations prescribed by President. Such District Boards shall have exclusive original jurisdiction within their respective areas to hear and determine all questions or claims for including or excluding or discharging persons or classes of persons from selective draft, under provisions of this act, not included within original jurisdiction of such Local Boards.

Decisions of District Boards shall be final except that in accordance with such rules and regulations as President may prescribe, he may affirm, modify or reverse any such decision.

Any vacancy in any such Local Board or District Board shall be filled by the President, and any member of any such Local Board or District Board may be removed and another appointed in his place by the President, whenever he considers interest of nation demands it.

The President shall make rules and regulations governing organization and procedure of such Local Boards and District Boards, and providing for and governing appeals from such Local Boards to such District Boards, and reviews of decisions of any Local Board by District Board having jurisdiction, and determining and prescribing several areas in which respective Local Boards and District Boards shall have jurisdiction, and all other rules and regulations necessary to carry out terms and provisions of this section, and shall provide for issuance of Certificates of Exemption, or partial or limited exemptions, and for a system to exclude and discharge individuals from selective draft.

DRAFT AGE LIMITATIONS

Sec. 5. That all male persons between the ages of 21 and 30, both inclusive, shall be subject to registration in accordance with regulations to be prescribed by President; and upon proclamation by President or other public notice given by him or by his direction stating time and place of such registration it shall be duty of all persons of designated ages, except officers and enlisted men of Regular Army, Navy and National Guard and Naval Militia while in service of U. S., to present themselves for and submit to registration under provisions of this act; and every such person shall be deemed to have notice of requirements of this act upon publication of said proclamation or other notice as aforesaid given by President or by his direction; and any person who shall wilfully fail or refuse to present himself for registration, or to submit thereto as herein provided, shall be guilty of a misdemeanor and shall, upon conviction in district court of U. S. having jurisdiction thereof, be punished by imprisonment for not more than one year, and shall thereupon be duly registered: Provided, That in call of docket precedence shall be given, in courts trying the same, to trial of criminal proceedings under this act: Provided further, That persons shall be subject to registration as herein provided who shall have attained their twenty-first birthday and who shall not have attained their thirty-first birthday on or before the day set for registration, and all persons so registered shall be and remain subject to draft into forces hereby authorized, unless exempted or excused therefrom as in this act provided: Provided further, That in case of temporary absence from actual place of legal residence of any person liable to registration as provided herein such registration may be made by mail under regulations to be prescribed by President.

Sec. 6. That the President is hereby authorized to utilize service of any or all departments and any or all officers or agents of U. S. and of the several states, territories and District of Columbia, and subdivision thereof, in execution of this act, and all officers and agents of U. S., and of states, territories and subdivisions thereof, and of District of Columbia, and all persons designated or appointed under regulations prescribed by President whether such appointments are made by President himself or by governor or other officer of any state or territory to perform any duty in execution of this act, are hereby required to perform such duty as President shall order or direct, and all such officers and agents and persons so designated or appointed shall hereby have full authority for all acts done by them in execution of this act by direction of President. Correspondence in execution of this act may be carried in penalty envelopes bearing frank of War Department. Any person charged as herein provided with duty of carrying into effect any of provi-

sions of this act or regulations made or directions given thereunder, who shall fail or neglect to perform such duty; and any person charged with such duty or having and exercising any authority under said act, regulations, or directions who shall knowingly make or be a party to the making of any false or incorrect registration, physical examination, exemption, enlistment, enrolment, or muster; and any person who shall make or be party to making of any false statement or certificate as to fitness or liability or himself or any other person for service under provision of this act, or regulations made by President thereunder, or otherwise evades or aids another to evade requirements of this act or of said regulations, or who, in any manner, shall fail or neglect fully to perform any duty required of him in execution of this act, shall, if not subject to military law, be guilty of a misdemeanor, and upon conviction in district court of U. S. having jurisdiction thereof, be punished by imprisonment for not more than one year, or, if subject to military law, shall be tried by court-martial and suffer such punishment as a court-martial may direct.

VOLUNTARY ENLISTMENTS

Sec. 7. That qualifications and conditions for voluntary enlistment as herein provided shall be same as those prescribed by existing law for enlistments in Regular Army, except that recruits must be between ages of 18 and 40 years, both inclusive, at time of their enlistment; and such enlistments shall be for period of emergency unless sooner discharged. All enlistments, including those in Regular Army Reserve, which are in force on date of approval of this act and which would terminate during emergency, shall continue in force during emergency unless sooner discharged; but nothing herein contained shall be construed to shorten period of any existing enlistment: Provided, That all persons enlisted or drafted under any of provisions of this act shall as far as practicable be grouped into units by states and political subdivisions of same: Provided further, That all persons who have enlisted since Apr 1, 1917, either in Regular Army or in National Guard, and all persons who have enlisted in N. G. since June 3, 1916, upon their application, shall be discharged upon termination of existing emergency.

The President may provide for discharge of any or all enlisted men whose status with respect to dependents renders such discharge advisable; and he may also authorize employment on any active duty of retired enlisted men of Regular Army, either with their rank on retired list or in higher enlisted grades, and such retired enlisted men shall receive full pay and allowances of grades in which they are actively employed.

GENERAL OFFICERS

Sec. 8. That the President, by and with advice and consent of Senate, is authorized to appoint for period of existing emergency such general officers of appropriate grades as may be necessary for duty with brigades, divisions and higher units in which forces provided for herein may be organized by President, and general officers of appropriate grade for several Coast Artillery districts. In so far as such appointments may be made from any of forces herein provided for, appointees may be selected irrespective of grades held by them in such forces. Vacancies in all grades in Regular Army resulting from appointment of officers thereof to higher grades in forces other than Regular Army herein provided for shall be filled by temporary promotions and appointments in manner prescribed for filling temporary vacancies by Sec. 114, National Defense Act, June 3, 1916; and officers appointed under provisions of this act to higher grades in forces other than Regular Army herein provided for shall not vacate their permanent commissions nor be prejudiced in their relative or lineal standing in Regular Army.

EMERGENCY APPOINTMENTS

Sec. 9. That appointments authorized and made as provided by second, third, fourth, fifth and sixth paragraphs of Sec. 1 and by Sec. 8 of this act, and temporary appointments in Regular Army authorized by first paragraph of Sec. 1 of this act, shall be for period of emergency, unless sooner terminated by discharge or otherwise. The President is hereby authorized to discharge any officer from office held by him under such appointment for any cause which, in judgment of President, would promote public service; and general commanding any division and higher tactical organization or territorial department is authorized to appoint from time to time military boards of not less than three nor more than five officers of forces herein provided for to examine into and report upon capacity, qualification, conduct and efficiency of any commissioned officer within his command other than officers of Regular Army holding permanent or provisional commissions therein. Each member of such board shall be superior in rank to officer whose qualifications are to be inquired into, and if report of such board be adverse to continuance of any such officer and be approved by President, such officer shall be discharged from service at discretion of President with one month's pay and allowances.

ENLISTED PAY INCREASE

Sec. 10. That all officers and enlisted men of forces herein provided for other than Regular Army shall be in all respects on same footing as to pay, allowances and pensions as officers and enlisted men of corresponding grades and length of service in Regular Army; and commencing June 1, 1917, and continuing until termination of emergency, all enlisted men of Army of U. S. in active service whose base pay does not exceed $21 per month shall receive an increase of $15 per month; those whose base pay is $24, increase of $12 per month; those whose base pay is $30, $36 or $40, an increase of $8 per month and those whose base pay is $45 or more an increase of $6 per month: Provided, That increases of pay herein authorized shall not enter into computation of continuous service pay.

Sec. 11. That all existing restrictions upon detail, detachment and employment of officers and enlisted men of Regular Army are hereby suspended for period of present emergency.

UNITED STATES—Continued

AGAINST LIQUOR AND DISORDERLY RESORTS

Sec. 12. That the President, as Commander-in-Chief of the Army, is authorized to make such regulations governing prohibition of alcoholic liquors in or near military camps and to officers and enlisted men of Army as he may from time to time deem necessary or advisable: Provided, That no person, corporation, partnership or association shall sell, supply or have in his or its possession any intoxicating or spirituous liquors at any military station, cantonment, camp, fort, post, officers' or enlisted men's club, which is being used at time for military purposes under this act, but Secretary of War may make regulations permitting sale and use of intoxicating liquors for medicinal purposes. It shall be unlawful to sell any intoxicating liquor, including beer, ale or wine, to any officer or member of military forces while in uniform, except as herein provided. Any person, corporation, partnership or association violating provisions of this section or regulations made thereunder shall, unless otherwise punishable under Articles of War, be deemed guilty of a misdemeanor and be punished by fine of not more than $1000 or imprisonment for not more than twelve months, or both.

Sec. 13. That Secretary of War is hereby authorized, empowered and directed during present war to do everything by him deemed necessary to suppress and prevent keeping or setting up of houses of ill fame, brothels or bawdy houses within such distance as he may deem needful of any military camp, station, fort, post, cantonment, training or mobilization place, and any person, corporation, partnership or association receiving or permitting to be received for immoral purposes any person into any place, structure or building used for purpose of lewdness, assignation or prostitution within such distance of said places as may be designated, or shall permit any such person to remain for immoral purposes in any such place, structure or building as aforesaid, or who shall violate any order, rule or regulation issued to carry out object and purpose of this section shall, unless otherwise punishable under Articles of War, be deemed guilty of a misdemeanor and be punished by fine of not more than $1000 or imprisonment for not more than 12 months or both.

[The New Selective Draft. To Classify Drafted Men. *Army & Navy Jour.*, Oct 27, '17. 1700 words.]

"With the completion of the draft of the first army of 687,000 men a new system will be installed for the creation of succeeding armies, which will greatly lessen the labors of the local and district boards.

"Along with the reduction of labor there will be provided a system which will classify each one of the 9,000,000 men who have not yet been inducted into military service, and each man will have been given his place in the national scheme of defense. To do this it has been determined to obtain from each man complete information of a character which will definitely fix his economic worth as compared with his fellow registrant, and, from the information thus obtained, to place him in one of five classes, each to be called in turn as the need arises.

"The method of obtaining this information is thru a questionnaire, a series of questions calculated to produce the information required. This document will be mailed to every registrant not yet in service, on a day to be fixed, seven days being given to each registrant to complete and return same. Every opportunity will be offered to each man to complete his questionnaire fully and without error. The local boards will then examine each questionnaire and assign each registrant to one of five classes.

"These classes will be based upon every conceivable condition, from the family or occupational standpoint, that should properly be advanced by a man desiring to be excused from military duty. Class 1 will be the first called for physical examination and service, and when it is exhausted, if the nation's needs are such as to make it necessary, Class 2 will follow, and thus each man registered will ultimately take his place if needed. Every opportunity for appeal from such classification by the local board has been retained and perfected, but proceedings have been greatly simplified."

The tedious work of the local boards has been practically eliminated by the production of a form to be known as No. 1000, the foundation stone of the new system, which will eliminate much laborious work. On this new form the complete history of each man's case will appear at a glance, beginning with his order number and ending with his induction into a military camp. The new system fixes a man's class, and calls him in his proper turn, when he is needed. He will be examined physically only when needed. Thus the labors of the medical officers will be called for only when required.

The classification are as follows, and show every man registered to which class he belongs and in what order the different classifications will be called to service. It will be noted that all the groups in Class V are exempted from the operations of the draft.

CLASS I

1. Single men without dependent relatives. 2. Married man (or widower) with children who habitually fails to support his family. 3. Married man dependent on wife for support. 4. Married man (or widower) with children, not usefully engaged, family supported by income independent of his labor. 5. Men not included in any other description in this or other classes. 6. Unskilled laborer.

CLASS II

1. Married man or father of motherless children, usefully engaged, but family has sufficient income apart from his daily labor to afford reasonably adequate support during his absence. 2. Married man—no children—wife can support herself decently and without hardship. 3. Skilled farm laborers engaged in necessary industrial enterprise. 4. Skilled industrial laborers engaged in necessary agricultural enterprise.

CLASS III

1. Man with foster children dependent on daily labor for support. 2. Man with aged, infirm or invalid parents or grandparents dependent on daily labor for support. 3. Man with brothers or sisters incompetent to support themselves, dependent on daily labor for support. 4. County or municipal officer. 5. Firemen or policemen. 6. Necessary artificers or workmen in arsenals, armories and navy yards. 7. Necessary Custom House clerk. 8. Persons necessary in transmission of mails. 9. Necessary employees in service of United States. 10. Highly specialized administrative experts. 11. Technical or mechanical experts in industrial enterprise. 12. Highly specialized agricultural expert in agricultural bureau of state or nation. 13. Assistant or associate manager of necessary industrial enterprise. 14. Assistant or associate manager of necessary agricultural enterprise.

CLASS IV

1. Married man with wife (and) or children (or widower with children) dependent on daily labor for support and no other reasonably adequate support available. 2. Mariners in sea service of merchants or citizens in United States. 3. Heads of necessary industrial enterprises. 4. Heads of necessary agricultural enterprises.

CLASS V

1. Officers of states or the United States. 2. Regularly or duly ordained ministers. 3. Students of divinity. 4. Persons in military or naval service. 5. Aliens. 6. Alien enemies. 7. Persons morally unfit. 8. Persons physically, permanently or mentally unfit. 9. Licensed pilots.

It is a coincidence that only six days before the announcement of the above plan, Lieut.-Col. Paul Azan, of the French Army, in a lecture in Boston, laid great stress on this particular point of "military misjudgments." He criticized the French Government's blindness in the past in the matter of real selective service. He pointd out that when war was declared in France the first effort was concentrated on getting the men into arms and forward to the front. Provision had been made for getting men into the infantry, artillery and cavalry, and for keeping the railroad men at work. But then it was discovered that there were needed men for making munitions, men for the aviation service, engineers for constructing heavy artillery, chemists and scientists for crucially important tasks of the war." But when the time came to recall these men hundreds of them had already been killed in the early battles of the war. Colonel Azan said that the "all-inclusiveness of modern warfare might well have been foreseen." He declared that the modern general-in-chief must not only be a leader of men, but he must also be profoundly versed in economics, political science, the resources of various nations, in geography, in commerce. He said that in his own army in the past an officer who cultivated such knowledge was not only looked upon with suspicion by his comrades, but held to be in some sense false to his proper life as a soldier.

[Universal Service—The Nation's Mainstay. By Maj. C. S. Bryan, U.S.R. *National Service,* Sept, '17. 1800 words.]

(This article sets forth briefly some of the arguments for universal military service as opposed to the volunteer system.)

The founders of the government of the United States having been English, it is but natural that the laws, customs and ideals of the new nation should have been founded on those of the mother country. The civilization of the Anglo-Saxon is of the highest and his virtues many, but his love of personal liberty and disinclination to change his ways have all but cost him his liberty.

The people of the two great Anglo-Saxon nations have before now paid dearly for their adherence to the volunteer system. They are now once more reaping the fruits of their folly. Had they been willing to submit to universal service in past years the present war with its staggering losses of blood and treasure might never have occurred and would certainly have been shortened.

Now that the system has been adopted in principle for the prosecution of the war, it is to be hoped that it will be continued. The advocates of Universal Service are not desirous of building up a military machine, but rather to train the manhood of the nation physically, morally and mentally, teaching it a sense of duty and obligation to the government and a love of the flag and the principles for which it stands.

—Militia

See also

UNITED STATES—ARMY—RESERVE
UNITED STATES—MILITARY POLICY OF

—Motor Transport

See

MOTOR TRANSPORT—UNITED STATES

—Munitions—Manufacturing Facilities

See also

MUNITIONS—MANUFACTURING FACILITIES OF—UNITED STATES

[Manufacture of Munitions. Editorial. *Army & Navy Jour.,* Jan 6, '17. 500 words.]

The latest reports of the arsenals show that the cost of manufacturing rifle ammunition has risen from $25 to $36 per thousand rounds in the last year. All materials have risen in cost. Money is available to purchase and store a reserve of nitrates, and it is estimated that 30,000,000 pounds will be held in reserve. The Indian Head nitrate plant has turned out at a cost of $270,000 nitrate that would have cost $630,000 to buy. By June 30, 1917, there will be 400,000,000 rounds of small arms ammunition on hand, and within two years about two billion. 1300 rounds are regarded as an appropriate amount for each rifle, and 27,000 rounds for each machine gun.

Notwithstanding the placing of orders for allied munitions in Canada of late, the U. S. manufacturers will continue to do much of the work.

UNITED STATES—Continued

[Report on Munitions Manufacture. *Army & Navy Jour.*, Jan 6, '17. 250 words.]

The report of a special board of three army officers and two civilians has been sent to the Senate. This board recommends against exclusively governmental manufacture and in favor of the development of private sources of supply of munitions.

The board recommends the enlargement of the Rock Island Arsenal and modern machinery for all arsenals; standardization of tools, gauges, etc.; and the accumulation of raw materials for one year's manufacture of munitions. For exclusive Federal manufacture of munitions, plants in peace would cost $52,000,000, and in war $927,000,000.

—Naval Policy of

See also

UNITED STATES—MILITARY POLICY OF

[Some Strategical Sketches. By Professor William Hovegard, Royal Danish Navy. *Proc. U. S. Naval Institute*, Feb, '17. 5500 words.]

The United States Navy appears to stand on the threshold of a great enlargement. The constitution of the fleet and the choice of types of vessels, press for immediate solution.

These questions may be answered best by considering as nearly as may be from all known data the probable steps in case of war between the United States and England, Germany, Japan, or Germany and Japan together.

With England, the issue of the war would be determined on shore; namely the North American Continent. England would control in a short time the sea and be free to strike at the Panama Canal. Also she could then transport troops to Canada, from which base the land campaign would proceed.

In the case of war between Germany and the United States we would find the German navy somewhat stronger than that of the United States in battleships and overwhelmingly superior in cruisers, destroyers and submarines. Germany has no advanced base and would probably immediately move to seize one on the Eastern Caribbean. Whether the great naval conflict would come at this time or later would be a question.

Certainly from facts recorded the German navy would seem to have at least a fair chance of victory. Should the Germans be victorious, land forces could be transported and invade the United States, whose hurriedly organized civilian soldiery would be no match for the trained German legions.

In war with Japan the United State Navy would be decidedly superior in battleships, but would lack the element of speed possessed by the Japanese Navy in its squadron of battle cruisers.

The Panama Canal would be of the utmost strategic value. Of all the possible eastern naval bases Guam appears the easiest to make impregnable and it seems would be absolutely indispensable to the United States in a war with Japan. It should be thoroly fortified at once. The Japanese would no doubt open the war by a surprise attack from Formosa as an advance base. Once established in the Western Pacific Japan would follow a defensive policy. It is difficult to see how the American fleet could force a decision on the Japanese Navy against its will, and no operations could be conducted without a naval base near to Japan. It is likely that the main United States fleet would remain at Hawaii protecting the Pacific Coast and the Canal.

The war would be essentially a cruiser war, in which Japan would have the advantage of a more modern and powerful matériel.

If Germany and Japan acted together against the United States the naval power would be strongly superior, but their forces would be initially divided and their combined strength would still be short of that of Great Britain.

With the American fleet in the Atlantic, conditions in that field would be practically as in the conflict with Germany alone. The fleet could not be detailed to guard the Pacific entrance of the Canal, which undoubtedly would fall into the hands of a Japanese army convoyed to the Canal by a strong fleet. All the outlying possessions of the United States would certainly fall into Japanese hands and the fate of Pearl Harbor would be similar to that of Kiao-Chou. Should the American defeat the German fleet, after a period of recuperation it would eventually clear the Pacific. If defeated, however, both coasts would be open to immediate invasion.

—Navy

See also

ARMOR—MANUFACTURE OF—UNITED STATES

EUROPEAN WAR—NAVAL POWER IN

TORPEDOES—NAVAL—UNITED STATES

[Our Billion Dollar Navy. By Josephus Daniels. *Independent*, Mar 26, '17. 1500 words.]

During the first administration of Woodrow Wilson $1,135,000,000 were appropriated for the navy. The three-year program adopted authorizes the construction of 156 vessels of different types, including 7 battleships, 5 battle cruisers, 7 scout cruisers, 35 destroyers, 48 submarines. In the latest Naval bill $133,000,000 were appropriated for speeding up the construction of ships already authorized, and the purchase or construction of aircraft, additional destroyers, submarine chasers and other small craft, and for the construction of twenty coast submarines in addition to the eighteen provided in the three-year program. The base for submarines in the North Atlantic at New London, Conn., will be enlarged and fitted out.

[The American Navy. By Arthur Pollen. *Land and Water*, Apr 12, '17. 3400 words.]

America is now committed to make war side by side with the Allies in Europe and to employ the whole of the forces she can raise, all her financial power and all her industrial strength to bring the war to the speediest possible termination. Her object, like ours, is the utter and complete defeat of the military power of Prussia.

America's intervention gives new life to the finances of the Alliance just when it is wanted, it holds out

the promise of an indefinitely large military reinforcement, should the war go into the fourth winter, and it brings immediately into the field a very notable addition to the actual sea forces of the Allies.

As organized for peace the ships of the American Navy are placed in four groups. First, those in full commission; next, those in commission in reserve; thirdly, those commissioned in ordinary; and fourth, those out of commission altogether.

Fully commissioned ships constitute the Atlantic and Pacific fleets, the cruiser, destroyer and submarine squadrons and flotillas, and the cruisers, gunboats, etc., commissioned for independent duties. Amongst them are fourteen battleships, of which thirteen are of what is called the Dreadnought type; and thirteen cruisers, classified as armored, second class and third class. There are thirty-eight destroyers and submarines each; four monitors; three transports; five converted yachts; five torpedo tenders; seven or eight training or depot ships; eighteen gunboats; twenty colliers and oil tankers. All these ships are either at sea or ready for sea and the main strength of them constitutes the Atlantic Fleet.

The naval constructors have for many years been the equals of their fellows in Europe. The American Battle Fleet as it stands is exceptionally powerful. Sixty-four 14-inch and eighty 12-inch guns, all available on the broadside make a very formidable combination. It is believed that the American ordnance authorities have been singular in producing a weapon of 14-inch caliber that employs so high a muzzle velocity as 2700 feet per second. The accuracy of these guns at extreme range is said to be extraordinary and has only been equalled or surpassed by the British 15-inch guns, the shells of which of course weigh almost forty per cent more.

In the four ships laid down last year, *Maryland, West Virginia, Colorado* and *Washington,* the 16-inch gun has been adopted with a special view of surpassing the ranging capacities of the largest guns afloat in all other navies.

The weakness of the American Navy in commission is its poverty in cruisers. Its strength lies in its capital ships. Next to the poverty in light craft, the greatest weakness of the American Navy is lack of numbers in personnel. Mr. Daniels has stated that to put every useful ship which the United States possesses into full commission would require nearly one thousand more officers, over nine thousand more regular seamen and other ratings, and over twenty-three thousand reserves, after drawing upon nine thousand militia and such fleet reserves as exist. If these be the American navy's worst shortcomings, its greatest asset is the high spirit and equally high professional attainments of its officers and trained men. In no navy are the three elements, practice, scientific theory and naval doctrine more sedulously cultivated. And it is distinctly fortunate that the command of the Atlantic Fleet should be in the hands of so good a type of officer as Admiral Mayo. This commander now enters upon the most momentous command any American sea officer has held since the days of Farragut. It will be surprising if the employment of the American Fleet is not marked both by originality and effect.

—Navy—Aeronautics

See also

DIRIGIBLES—UNITED STATES

—Navy—Organization

[The Greater Need of the United States Navy. Proper Organization for the Successful Conduct of War. By Lieut.-Commander W. P. Cronan, U. S. Navy. *Proc. U. S. Naval Institute,* July-Aug, '16. Diagrams.]

All organized human effort is based upon the recognition of three factors which are co-equal and interdependent.

These three factors are first, information; second, reflection and study; third, execution.

The subject, discussed in the usual method of approaching a military problem, leads to the "decision" given at a glance in an interesting "family tree diagram" of a proposed organization of all the departments of the U. S. Navy.

—Officers

[Note. *Army & Navy Jour.,* Mar 24, '17. 85 words.]

The 340 officers of the provisional battalion of second lieutenants of the U. S. Army on duty at Fort Leavenworth, Kansas, will complete there three months' training about Apr 1, when they will be assigned to organizations of the army. The training of these officers has been intensive. Little attention has been given to the higher branches of military science, the aim being to educate them in soldier work in the field.

—Railroads

See

RAILROADS—UNITED STATES

UNIVERSITIES

—Military Training in

See

EDUCATION, MILITARY—IN SCHOOLS AND COLLEGES

URUGUAY

—Army—Officers

See

OFFICERS—INSTRUCTION AND TRAINING—URUGUAY

—History

See also

PARAGUAYAN WAR
SOUTH AMERICAN WARS OF INDEPENDENCE

UYEHARA, General Baron Yusaku

[Famous Engineers of the Allied Armies—Uyehara. By Maj. F. S. G. Piggott, D.S.O., R.E., *Royal Engineers Journal,* Feb, '17. 800 words.]

General Baron Yusaku Uyehara, Chief of the Japanese General Staff, was born on the 9th of November, 1856, and obtained his commission in the engineers in 1880. Passing thru all the regular grades he became Major-General in 1900, Lieutenant-General in 1906, and General in 1915.

UYEHARA, General Baron Yusaku—Continued

In the last six years he has come especially to the fore, having been successively Inspector of Engineers, Minister of War, Inspector-General of Military Education, and Chief of the General Staff.

VERDUN, Battle of

[The Battle of Verdun, 17 August to 10 September. By P. S. *Revista Militar* (Portugal). Dec, '16. 2000 words.]

(The article includes a picture of the medals presented to the city of Verdun by France and the allied countries.)

[Pushing the German from Verdun. By Edward Foord. *Sphere,* Dec 30, '16. 1000 words. Map.]

The German attack on Verdun died away by the end of June, and the activity shifted to the Somme. There were occasional actions at Verdun. Aug 1-3 the French regained Fleury and captured nearly 2000 prisoners.

On Oct 14 began the preparatory bombardment leading to a French attack on Forts Douaumont and Vaux. Weather delayed the assault until Oct 24. The Germans were apparently surprised. The left wing captured the Thiaumont work at Haudremont; the right wing captured everything up to the outskirts of Vaux; and the center, after five hours of desperate fighting, captured Fort Douaumont. In this general action, General Mangin's forces captured 5000 prisoners, 15 guns, 51 trench mortars and 144 machine guns. By Nov 5, Vaux and Damloup village and another 2000 prisoners had been captured.

The German line from Douaumont to the Meuse was held by five divisions. This line was attacked on Dec 15, after several days' bombardment, by five French divisions under General Mangin. The assault appears to have been the finest feat of leading and organization the war has seen. The progressive barrages were the last word in artillery protection, and the French infantry attacked like Napoleon's finest. The attack carried Louvemont, Vacherauville, Les Chambrettes and Besouvaux, with 11,000 prisoners, 115 guns and 153 trench mortars and machine guns. German counter attacks on Dec 16-17 failed to regain any of the lost ground. The victory was short, sharp, and decisive.

[Verdun and the Somme. By Hilaire Belloc. *Land and Water.* 4 Jan, '17. 3000 words.]

The operations upon the Somme and those against Verdun are contrasted as follows: The Verdun offensive was begun as soon as possible after the strategic failure of the Austro-German advance thru Poland. The five great attempts to envelop the Russian army had ended in disappointment. The Austro-German line had been drawn eastward to the breaking point. A decision before the summer of 1916 was necessary because of the increase in number of the Allies in the west, and their still greater increase in munitionment. Hence the Verdun offensive which ended in failure. Contrast the conditions under which the Somme offensive was undertaken. (1). Verdun had cost the Germans upon that one front and in five months alone more men than they could replace upon all fronts during a whole year.

(2) The Trentino offensive had failed and had failed at the cost of further very heavy losses to the Austrians upon the comparatively neglected Isonzo front.

(3) Brussilof on the 4th of June had broken the Austrian front in the east, was capturing prisoners at such a rate that in a few weeks they reached nearly 400,000, and was eliminating the equivalent of at least 40 Austrian divisions. Germany had to fill the gap by the sudden depletion of her reserve of man power; the changing of units to create new and smaller divisions, and the maintainance of a most expensive retreat.

Verdun was the end of a declining superiority upon the enemy's side. The Somme was the beginning of an increasing superiority upon that of the Western Allies.

VETERINARY SERVICE

See also
Horses

[Pseudo-Appendix of the Horse. By Ramón E. Maturna, 2d Class Veterinarian, Regiment of Artillery, Arica No. 2. *Mem. del Ejército* (Chile), Sept, '16. 1650 words.]

The following observations were made by the writer from cases which occurred in Feb, 1913, and in Oct, 1915.

The name *pseudo-appendicitis* has been given to the disease, because the foreign bodies causing the disease lodge themselves in the blind intestine, in the same manner that they are localized in the human appendix. The Latin word *pseudo,* meaning false, has been used because the horse has no appendix like a man.

The disease is caused by the intermingling, in the organism, of particles of sand and of other insoluble substances.

Tho the symptoms of the disease are very much like those of an attack of colic, it has certain characteristics:

1. The animal suffers periodic attacks of colic, fifteen to twenty days apart, and each attack lasts from two to four hours.

2. Intestinal noises are noticed as in a normal horse, which is not the case with animals having an attack of colic.

3. There is a pain running along the median line of the abdomen. This pain can be detected by a pressure on the abdomen.

4. The droppings contain sand and other foreign substances.

5. The disease degenerates into enteritis. The temperature rises to 41°; this fever does not appear in ordinary cases of colic.

Course and Length of the Disease

Horses die from ten days to eight months after having eaten sand. The following observations have been made:

DIED

Horse no.	1,	after 10 days;	30 kgs.	of sand found.	
"	2,	" 20 "	20	" "	"
"	3,	" 22 "	20	" "	"
"	4,	" 30 "	15	" "	"
"	5,	" 30 "	15	" "	"
"	6,	" 45 "	8	" "	"
"	7,	" 60 "	5	" "	"
"	8,	" 90 "	3	" "	"
"	9,	" 180 "	200	" "	"

About 80 per cent. of the animals affected die. Those which survive remain in very poor condition.

Treatment of the Disease

1. As soon as the disease is noticed put the animal on a light feed, green grass, bran and plenty of water.
2. Give 5 doses of 300 grams of Palma Christi oil, doses 3 days apart.
3. Clean out the rectum daily; then insert four or five quarts of warm water, which has been boiled and contains 10 per cent. of glycerine.

Instead of the nosebag, which has many weak and unsanitary features, the use of a piece of canvas, 40 by 35 cm., to be made up in the shape of a trough and to be suspended from the picket rope, is recommended. Each trough should not weigh over 400 grams.

—Organization and Administration

[The Army Veterinary Service, 1914-1916. By Maj. J. W. Rainey, R. of O., A.V.C. *Journal R. U. S. Institution*, May, '17. 12,000 words.]

The present war is the first in which a Veterinary Service has been permitted and aided to carry out a definite scheme of its own, and a study of the results obtained is valuable.

Primarily, an Army Veterinary Corps must justify its cost on economic grounds. The following figures throw some light on this:

(a) The total wastage among horses and mules of all the British forces, including losses from all sources whatsoever, during 1916, was 13% of the total animal strength. The mortality alone was 9.47%.

(b) The total wastage among Army horses and mules during 1912 (*i. e.*, during peace) was 14.80%.

(c) The mortality among Army animals in the South African War, 1899-1902, was more than 55%. At this time there was no Army Veterinary Corps.

(d) The mortality in the campaigns in German South-West Africa up to the present time has been 9.09%. A Veterinary Corps identical with that of the Imperial Army has been with the Union forces here.

Comparing (a) and (b) we see that the wastage during the past year, 1916, among probably the greatest number of horses and mules ever gathered together, has been less than that of peace times, this in spite of losses from gunfire and the chances of war and notwithstanding the fact that most of the animals have been standing in the open day and night in every sort of weather.

From (c) and (d) we see that under similar conditions of warfare in the same region the mortality rate of 1899-1902 has been cut down more than five-sixths by the work of the A. V. C.

The officers of the A. V. C. are graduates of British and Colonial veterinary colleges. The number of officers available for duty in August, 1914, was 109. Today there are over 1200 officers and more than 20,000 N. C. O.'s and men, exclusive of native Indian and Egyptian personnel.

The work of the Army Veterinary Service comprises:

1. The examination for soundness of all animals prior to their purchase for the Army.
2. Care of remounts on board ship.
3. Prevention and control of contagious and other diseases among all army animals.
4. Treatment of minor cases of sickness and injury under regimental arrangement with the unit to which the animals belong.
5. Evacuation to veterinary hospitals of all cases of sickness or injury that cannot be treated properly with the unit, or that, for military reasons, it is not desirable to retain with the unit.
6. Maintenance of an efficient standard of horse-shoeing thruout the Army.
7. Supply of veterinary medicines and equipment.
8. The training in schools of farriery of shoeing-smiths and cold-shoers required for the army.
9. Careful observance of and advice upon all matters directly or indirectly affecting the welfare of the army horse, *e. g.*, stable-management, forage and feeding, watering, etc.

The policy of the Army Veterinary Service is that "prevention is better than cure." To protect a horse adequately he must be inspected at least once daily. With a strength of many hundreds of thousands of horses, it is readily seen that for this service alone an enormous organization is required.

To illustrate the complexity and the possibilities of equine preventive medicine, we may consider the outbreaks of equine influenza and pneumonia. This class of disease is the greatest scourge of the domesticated horse and offers in the early stages practically only one abnormal symptom—a rise in temperature. A horse at this stage will die, or become seriously ill, if taken out and worked. Since practically every remount undergoes an attack of this sort subsequent to purchase and prior to beginning military training, the A. V. S. has enforced the rule that no remount can be embarked or transferred from a remount depôt unless his temperature has been taken and found normal not later than the day preceding his journey. This rule has probably saved thousands of horses.

Horses on Board Ship

The A. V. S. has had full charge of the care and arrangements for horses and mules on shipboard. Veterinary surgeons were sent with the purchasing commissions to other countries and one surgeon and an assistant were allotted to each horse or mule transport. Due to the work of the conducting officers, the total loss on all horses and mules shipped from the beginning of operations to the present date has been kept down to slightly more than 1%. An important improvement on horse-ships has been the use of pens

VETERINARY SERVICE—Continued

in which animals are carried free, each pen containing five horses or mules. Formerly single stalls, 2 feet 6 inches wide, were used. The pen gives more freedom, better sanitation and ventilation, and permits an animal to lie down.

Work of A. V. C. at the Front

The work at the front is largely of a preventive and first-aid nature. In each division there are a mobile veterinary section and a first-aid section. The officers and N. C. O.'s of the latter section are distributed among the fighting units and are responsible for first-aid treatment and for deciding what cases must be removed to the veterinary hospitals. They also carry out the daily inspections before mentioned. Every animal is able to receive at all times the attention needed. Open-wound dressing is practised for the most part.

Probably the best form of field dressing for horses discovered up to the present is as follows:

Foreign bodies are removed from the wound as far as possible without probing. Shreds of damaged tissue, certain to die and decay if left *in situ*, are similarly removed with the dressing scissors. The wound is then gently cleansed with antiseptic wool, facilities for downward drainage of discharge are established, and the dressing is completed by painting all exposed tissues with tincture of iodine.

The mobile section collects all animals that are to be sent to the hospitals. It also acts as a dressing station and brings up medicine and equipment from the base, distributing these stores among the first-aid units.

Veterinary Hospitals

The average overseas hospital is of a size to deal with 1250 or more cases at one time and has a personnel of over 400 officers and men. There are about thirty of these hospitals.

Each hospital is sub-divided into wards, each ward being as far as possible appropriated to the treatment of a separate class of injury or disease. One hospital is confined to the treatment of the skin disease known as mange. Horses with this disease are completely immersed in steam heated vats filled with the necessary medicaments.

In the Expeditionary Force, 80% of all cases admitted to veterinary hospitals are returned to duty thru the remount depôts. Of the remaining 20% a considerable number are painlessly killed and sold at a good price to the local inhabitants for human consumption.

The hospital buildings are of steel or cast iron with roof and center divisions of corrugated iron. The flooring is of ashes and railway sleepers or preferably, of cement. Each horse has a space of 5½ feet.

During the winter months especially, a constant stream of horses pours into the hospitals. These animals for the most part are not diseased or wounded but merely weakened. Except in the case of old animals, such horses recuperate rapidly.

Horses over twelve years of age, altho resistant to contagious disease, have generally lost their recuperative powers and should not be purchased for war purposes. On the other hand, horses under six years of age are very susceptible to disease and stand the hardships of campaign badly.

In Egypt there are three camel hospitals, each of a capacity to handle 1250 camels.

Glanders and Mallein

From earliest times, glanders has caused large losses among horses in time of war. It is a particularly deadly disease and is highly infectious. The A. V. C., by the use of mallein has kept the mortality from glanders down to less than 1% of the total mortality from equine disease in general.

Mallein is a substance prepared from killed cultures of the glanders bacillus to which have been added glycerine and carbolic acid. When inoculated with mallein, a sound horse will show no effects but in a horse with glanders there is a marked reaction, swelling and rise of temperature, within twenty-four hours. The mallein used is a new French variety of which two drops, injected into the eyelid, give a more delicate and certain test than the previous form.

Every remount is tested before purchase and, if shipped from overseas, is tested again on arrival. Finally, all animals destined to be sold back to civilians are again tested. During the past two years only two cases have occurred in which army animals have developed glanders after such transfer to civilian communities.

Horse Ambulances

Both motor ambulances and horse-drawn ambulances are used, the latter predominating. The use of these ambulances saves many animals which otherwise would have to be destroyed. Injuries to the feet bulk largely in the list of troubles to which the war horse is subject, and the principal cause of this class of injury is the picking up of iron nails. These work into the foot, causing infection and subsequent lameness. In such cases the ambulance is invaluable and, as the number of picked-up nail cases amounts to several hundred a week in France, it justifies its cost on this item alone. Efforts are being made to provide a light movable metal protection that will prevent the penetration of nails into the sole.

Army Schools of Farriery

With the heavy work in France a set of shoes barely suffices a gun-team horse for 100 miles, about five days constant marching. Foreseeing the imperative need for shoeing-smiths, extraordinary steps were taken to obtain and train them at the beginning of the war.

The A. V. C. has established several schools of farriery, each turning out 1000 cold-shoers every three months. The system of instruction and the examination is uniform and each pupil sent out receives extra-duty pay. A novel and effective innovation is a dummy to which a dead horse's foot is attached and on which the foot can be handled just as the foot of a live horse is handled in shoeing.

The schools are located near remount depôts and the assistant instructors are largely drawn from retired and re-enlisted Army farriers. In addition to instruction in the art of shoeing, the pupils are given a short course in first-aid surgery of the horse's foot. About stockholders, while giving the corporation extensive two months' intensive training is required to turn out a competent "cold shoer" and three months more are needed to qualify a man as a "shoeing-smith."

WAR

See also

Preparedness for war

Strategy

[War and Its Modern Causes. By A. de Q. *Memorial de Caballeria,* July, '16. 2500 words.]

Wars today are not caused by the military. States endeavor thru war to get markets, to bring about commercial supremacy, or to secure new territories in which to colonize their surplus population. It may truthfully be said that in the present state of human progress economic reasons engender these violent conflagrations. The object of wars now is nothing more or less than to destroy with warships and heavy guns the obstacles to commerce and industry placed by commercial rivals. The war with the United States was provoked by the Yankees for commercial reasons. The United States needed markets for manufactured products. The trade with Europe was not sufficient because of the competition in freights and the probability of a tariff war. The security and ease of commercial achievement in the extreme Orient inspired a new political economy to further which merchant fleets and a relatively strong navy were constructed. The Union wanted a *Yankee* sea, *Yankee* factories and *Yankee* naval stations echeloned towards China, which country was selected for exploitation. The catastrophe of the *Maine* came, San Juan, Porto Rico filled the *desideratum,* protected Cuba offered her ports; the Philippine Islands offered the naval and commercial bases longed for. We were despoiled of our islands. This war was most fortunate, however, for Spain and her industrial development and internal prosperity date from it. (Here follow the views of the writer on the causes of the Boer war and the Russo-Japanese war, both of which he likewise ascribes to commercial competition. His conclusion is that commercial competition breeds political antagonism and is the principal cause of war.)

[Is War Diminishing? A Study of the Prevalence of War in Europe from 1450 to the Present Day. By Frederick Adams Woods and Alexander Baltzly. Boston: Houghton Mifflin Co., 1915. 12mo, pp. xiii, 105. $1.00 net (A Review from *The Journal of Practical Economy,* Jan, '17.)]

In the introductory chapter of this book Dr. Woods insists upon the need of a scientific study of war—its nature, its causes, and more particularly its prevalence at different stages of history. Our pacificists, he complains, assume the advantages of peace, and pretend, without showing adequate evidence, that peace will more and more supplant warfare. Nor are the champions of militarism much less content with preconceptions and idle generalizations.

The body of the book attempts to supply tangible evidence on at least one point: has the prevalence of war diminished among the principal European countries during the last five or six centuries? The labor of compiling this evidence has fallen largely to Mr. Baltzly. The result is a careful statement of the years of peace and the years of war in the history of each of the nations considered. At the end of the volume a series of historical charts makes the results of the compilation visible. The authors conclude that their data do not demonstrate any very decided abatement of warfare, especially among the stronger powers.

It must be insisted, however, that the significance of war cannot be tested simply in terms of duration. There may be a vast difference of import between lingering dynastic quarrels and violent conflicts of whole nations; or between wars tantamount to the policing of savage tribes and wars that engulf half of civilization. In the diagrams here under review Gordon's Soudan campaign counts in English history as the equivalent, year for year, of the present European war. No further comment is necessary to show the inadequacy of such an analysis. Perhaps, after all, this book will achieve its most useful result by showing how far we fall short of that adequate objective knowledge upon which alone, in Dr. Wood's contention, discussion of militarism and pacifism can probably be based.

—Conduct of

[The Problem of Higher Command. *Memorial del Ejército de Chile,* Mar, '17. 8800 words.]

The European war has demonstrated to the world the superiority of German military preparation to that of the other belligerents.

The factors which beyond doubt constitute the essence of this superiority are:

1. The efficiency of military administration, which at a relatively small expense has permitted the development of an army unsurpassed in the history of the world.

2. The great military strength derived from conscientious and strict compliance with the duties of national defense on the part of all citizens able to bear arms.

3. The excellent preparation of the higher command.

It may be observed here that frequently two concepts are confused in the use of the phrase "higher command." The one is the superior direction of military matters which clearly should be exercised by the executive assisted by his minister of war, and naturally with the collaboration of the Inspector General of the Army, the chiefs of the four military "commands" and the Chief of the General Staff.

The other is the instruction, training and employ of military units in time of peace, and their direction in the field in the presence of the enemy. This can be executed only by professionals. Whether the Minister of War be civil or military his workshop, the ministry

WAR—Continued

of war, should be scientifically organized in departments under officers of personality and force.

The preparations for and the conduct of war have always been difficult and complicated. The names of great generals are given a place among the geniuses of the world. But the action of only one man is not enough for the successful handling of an army, as history has demonstrated on many occasions. It is necessary that the qualifications that pertain to the proper exercise of its functions by the higher command should be common to all its members. These fundamental qualifications are:

(a) Activity, which is manifested by initiative and zeal in the service.

(b) Character, founded in the conscious exercise of duty cost what it may, and in sentiments of patriotism and honor.

(c) Intelligence, shown by possession of the general and professional knowledge indispensable for fulfilling the duties of high military rank.

How is it that the German Higher Command after 50 years of peace (from 1815 to 1864) so brilliantly performed its duties in the years '64, '66, and '70-71? How is it that in the present war it has in the face of the greatest difficulties given such wonderful proofs of its capacity?

The German system of instruction is largely responsible.

The bases of this system are:

(a) The so-called field exercises, which are directed and executed in a rational manner leading to the end sought, namely; preparation for war.

(b) Journeys of instruction, either of strategic or tactical character.

(c) The war game, including the estimate of the situation and the working out on the map of the positions and movements of each element.

(Remarks follow which refer to methods of selecting officers for high command.)

—Governmental Conduct of

See also

ADMINISTRATION, MILITARY—WAR DEPARTMENTS AND MINISTRIES

—Laws of

See also

AERONAUTICS—LEGAL REGULATION OF
ESPIONAGE
EUROPEAN WAR—ATROCITIES IN
PRISONERS (OF WAR)

—Losses in

[Losses in War. *The Military Historian and Economist*, Apr, '17. 500 words.]

The death rate of the total number of men called to arms in all wars and armies for which figures are available remains substantially four per cent, or one out of twenty-five. The percentage of wounded is higher, being 18 per cent. The low death rate is due to better surgery and care for the wounded, and not to any lessening of exposure to hits.

These losses are for all men called to arms, and are not equally distributed. Many troops such as those used in garrisoning home or occupied towns, in the line of communications, in the reserve, etc., suffer but few casualties, while troops actively engaged probably average losses of 10 per cent for the offensive and 5 per cent for the defensive. Only the best troops, composed of young men thoroly disciplined and trained, under efficient officers, can hope to succeed in a difficult tactical offensive. Hence for such offensives the same troops must be used over and over again and transported from place to place for the most difficult work. How long such troops can be so used is not known, but it is interesting to note that in a sustained offensive (such as that of the Germans at Verdun) troops appear to be given a complete rest from the sound of battle of from two to three months, and are then used in the front line in an intensive attack for periods of from three to seven days.

—Moral Forces in

See also

MORALE
OFFICERS—QUALITIES OF

[The Christian Conscience and the Army. By Edouard Chapuisat, Captain and Judge Advocate. *Rev. Mil. Suisse*, Aug, '16. 6500 words.]

Argument of the prosecution in the case of J.B., fusilier, accused of insubordination, or refusing to serve on account of conscientious scruples.

A military tribunal condemned said J. B. to four month's imprisonment, forfeiture of civil rights for a year and costs for violation of his service obligations. The judgment was based on the fact that at the time his unit was assembled, B had declared to his company commander that his religious principles did not allow him to perform military service.

In explanation B described how, at the age of 19 years, having visited the battlefield of Gravelotte, he had occasion to talk with a man mending a road near the Saint Hubert farm. A realization of the hatred left in this man's heart by the war stupefied him.

Upon reflection, he concluded that war necessarily engenders hate and that, besides, a loss of liberty is not the worst of evils.

Called as a recruit, he was proud to have been considered fit for service but, very soon, he was disappointed at the instruction he received, all tending to the annihilation of the adversary.

He responded to the mobilization and took the oath of allegiance. He was demobilized some months afterwards, and sent to his home. A study of the Bible fixed him in his scruples so that, when he was called again he refused to serve. He was tried and sentenced as above indicated.

His father, an old soldier, knew that his son would persist in his ideas if he were again called out, so the elder B. made application for his son to be excused from active service. The authorities offered to transfer him to the hospital corps or the postal service, but he refused.

The next time he was called, he refused to go and placed himself at the disposition of military justice.

I might close the prosecution here and simply invoke

the law. But it seems to me that the prosecution would be inferior to the accused if it declined to study the motives of the latter.

Cases of conscience, when we are sure that they are cases of conscience and not of moral weakness, cases of conscience such as this have a right to our respect from the religious point of view.

We men cannot interfere with our neighbor's conscience. We can only let him be enlightened by it or attempt to enlighten him ourselves.

I would call his attention to this argument: "If it is admitted that the refusal on the part of pacific peoples to defend themselves could have no possible effect but to deliver the earth to the domination of militaristic peoples, then conscience will not prevent our performing our military service, because we do not know if it is not precisely that just war for which we are preparing . . ."

Or this argument: "If one does not approve, he can and ought, in that case, to try and have the law of military service modified, but not violate it, because that would be denying the social compact."

Another points out "considering the present moral state of the race, the imperative necessity that society should put force at the service of justice."

Altho B. merits our esteem by his private life and tho he is evidently sincere in his scruples, he is guilty in the sight of the law. I, therefore, recommend that he be sentenced to:

1°. One year's confinement;

2°. Dismissal from the army as provided in the military penal code under the name of degradation;

3°. Suspension of political rights for two years;

4°. Costs of the trial.

I believe it would be proper to recommend a mitigation of the sentence as regards confinement.

[Military Catechesis. By Capt. Ricardo Saenz de Inestrillas Y Pardo, *Mem. de Infantería* (Spain), Oct, '16. 1600 words.]

The most obvious lesson of the present war is that the will to conquer is the greatest talisman and the strongest force in the fighting armies.

The soldier is not and cannot be made a mechanical unit; with the improvement of his morale, the inculcation of the spirit of discipline, self-denial, and patriotism, he can be prepared for the most difficult and perilous enterprises, and in the reconstruction of nations following the present war this *preparation of the man* will be the chief study of those in whose hands rests the upbuilding of their peoples.

What religion is to civilization, so is patriotism to the State. Why should its teachings be limited to the barracks and to those who have already passed the age when sentiment best takes root in the human soul!

Nowadays our recruits enter the service grossly ignorant of its high purpose, morbid, suspicious, and without enthusiasm for the honorable life which is about to begin for them.

This unfortunate condition can and should be corrected and the way to accomplish it is to preach the doctrine of patriotism.

Every citizen destined for military service should have a mental and moral preparation as well as a technical instruction: this preparation should begin with the child, who should be taught the sanctity of country, flag and army, and should be confirmed and completed during the period of military service.

Much could be accomplished on this line by public orations in schools, churches, theaters, etc., on episodes connected with the glorious achievements of our armies and reflecting the brave and self-denying spirit of the Spanish soldier.

When people realize that the ideals and sentiments of the army are identical with their own and that the barracks are only other firesides where their brothers are dedicated to the common welfare, we shall have gone a long way toward developing that moral force which is so potent a factor of victory.

[Military Character. A Lecture Delivered by Commander F. H. Schofield, U.S.N., to the Officers of the Atlantic Fleet, June, 1913. *Jour. U. S. Artill.*, Nov-Dec, '16. 9000 words.]

Strategy and tactics are often regarded as questions of numbers, distances, times, and geographical conditions exclusively, but there is a spiritual side to strategy and tactics, and to every act of war. It is there that character finds expression. In recent years nations have recognized with increased clearness, not only that the spirit, morale, and character of their military forces are of supreme importance, but that the quality of these results largely from controllable forces.

It seems appropriate to bring to service attention the importance attaching to the character of the personnel and especially the character of the officers. Few of us have taken systematic steps toward the attainment of such a character as we esteem desirable. That it can be developed in a predetermined direction is shown by the study of history.

The military services are services made up of many individuals with a common aim, a constant readiness for the most efficient application of military force. Let us see what qualities of character are needed to unify and direct the efforts of all individuals of the service with maximum effectiveness.

The first idea is that of unity. We must act together, which implies a free acceptance of leadership and is a form of loyalty. Loyalty stands in the front rank of qualities necessary to a true military character. Side by side with unity is continuity of effort and this demands decision of character in all leaders. But military operations demand more than loyalty and decision of character. There is not time for the chief to give everywhere the impulse suitable to the occasion. The subordinates must see and act for themselves, have initiative in other words.

Loyalty is the central principle of military relationship. It is a form of partnership. Its aim is unity, and unity is a necessity in war. True loyalty is to the end to be attained and not to the individual, which requires full knowledge of the end or plan by all. But study and knowledge are necessary both to in-

WAR—Continued

spire and to develop true loyalty. Brilliant work on the part of leaders always is a powerful stimulant to the loyal attitude. But a subordinate must have a full knowledge of the end in view or the plan, otherwise he cannot be expected to act loyally or intelligently. This loyalty to the plan is important, as it requires a grasp of the situation and a visualizing of the future.

The individual who would be loyal must gain:

1. Knowledge of war derived from historical study and interpreted experience. This convinces him of the importance of loyalty.

2. Knowledge of the scheme and aims of the military organization, otherwise his loyal intention may be misdirected.

3. Knowledge of the matter in hand to guide his loyalty.

4. Confidence in the plan as a stimulant to loyalty.

5. Confidence in the leaders as they are a part of the plan.

The individual who wishes to be truly loyal will regard himself as a part of a great organization and have as his aim the efficient employment of his abilities to attain the end in view of the organization. Therefore he will refrain from:

1. Criticism of authority.

2. Resistance to orders and plans of authority.

3. Unnecessary interference in the duties of his subordinates.

Decision of character is the habit of meeting each situation that arises with a prompt, clear, and firm reply as to what shall be done and the way to do it. There is no place in a military organization for a man of indecision. He is a destroyer of unity and a retarder of speed.

Clear, firm decision is a mental act that requires the recognition of a task, an appreciation of the obstacles in the way, and a knowledge of the means at hand for overcoming them. From these data the man of decision adjusts means to ends by a logical and conclusive reasoning process. Every line of reasoning must be based upon premises. If he has not the requisite information, he must fall back on the best obtainable, but study and knowledge will assist him in interpreting incomplete information, and he will thus use his stored up knowledge in arriving at a logical decision.

To cultivate decision of character we must keep the brain working for effect. The habit of considering each situation a problem, always remembering there is a mission, and thinking to a conclusion, will build and strengthen decision of character. There are required to cultivate military decision of character:

1. Knowledge of war derived from study of history and interpreted experience.

2. Knowledge of the scheme and aims of the military organization.

3. Knowledge of the matter in hand derived from observation, from reports, and from the known or supposed desire of the chief.

4. Habitual exercise in comprehensive reasoning to a conclusion as distinguished from random thinking.

5. Habitual effort at definiteness of decision.

The man who seeks decision of character should decide knowingly if he can, ignorantly if he must, but in any case he should decide.

Initiative as a quality of military character means energy and aptitude in acting on one's own responsibility. This quality of character is one of the most valuable qualities of a military leader, either commander-in-chief or subordinate. Efficient co-ordination of effort, unity of effort, is the true goal of training for war. Centuries of experience have demonstrated that this requires a supreme head. As he cannot be everywhere at once, he must depend upon his subordinate leaders to execute his intentions. This requires that the subordinates act promptly in accordance with the ideas of the chief, and that their actions harmonize with the general plan. It is this phase which constitutes the value of initiative in subordinates.

A full and efficient use of initiative of character requires that he who exercises it have:

1. Knowledge of war derived from historical study and interpreted experience.

2. Knowledge of the scheme and aims of the military organization.

3. Knowledge of the matter at hand derived from reports and observation, from knowledge of the plan and end in view, and from knowledge of the doctrine that governs the attainment of the end.

4. Exercise in the application of knowledge and experience to concrete cases in accordance with the plan.

5. The habit of responsibility.

6. Loyalty.

7. Foresight and preparation.

To develop the qualities of loyalty, initiative, and decision in military character, we have found that one must acquire knowledge, knowledge of war derived from historical study and experience, and knowledge of the scheme and aims of our service. Casual reading will not yield what we are after, but the spirit of inquiry must dominate the mind that reads military history or theory for profit. Important ideas must be noted and filed away for future reference; to develop our own ideas, formulate them on several subjects of *study* in black and white. Knowledge alone is not enough. There must be exercise in using the stored up knowledge. If the duty on which engaged does not furnish the opportunity, one should create it for himself, following the methods employed at the War College.

A clear and constant perception of the goal, and the will to strive always towards it, are necessary to the man who would arrive.

[Echoes of the War, XVI. Moral Forces and Discipline. By Jose Paulo Fernandes, Capt. of Artillery. *Revista de Artilharia*, Dec-Jan, '16-'17. 3000 words. To be continued.]

(A brief review of the importance of discipline, the new discipline based on intelligence and moral force

which now obtains in the belligerent armies in Europe, and the changes which have taken place in this regard.)

[A Prologue. By R. Brice. *Mercure de France*, Jan 1, '17. 2000 words.]

During the first week of July, 1914, the 11th division of the 20th corps was maneuvering near the Camp of Mailly. This division, thanks to its qualities, had already earned the name of the "Iron Division." Upon the conclusion of the maneuver, the *critique* followed, at which were present General Balfourier, commanding the division, General Foch, and General de Castelnau, besides the brigade and the regimental commanders. This critique would have no special interest for us, in spite of the fact that General Foch gave a luminous analysis of the operations in hand, were it not that General de Castelnau, the last to speak, turned to Colonel de Cissey, commanding the 69th regiment, and asked him gravely: "Colonel, where would you like to die?" Embarrassed, the Colonel attempted no answer. Whereupon de Castelnau repeated his question, and this time the Colonel answered: "Why, I don't know, . . . I don't want to die." "What! You don't know?" exclaimed the general. "You don't know that in each soldier's life there comes a moment when he has nothing left but to die?" Then perceiving the confusion he had caused, he explained: "You are astonished, gentlemen, by the question I have just asked Colonel de Cissey. You have trained yourselves to make war in a scientific manner; but have you ever made up your minds to die? This is however necessary; it is an essential in our profession. Military honor is not average honor. It is not satisfied by the first effusion of blood. Our duty has but one limit, the last of all, beyond which we can do no more than to quicken the souls of men by the recollection of our example, beyond which our intelligence, our will, our energy, our courage, all are annihilated: that limit is death."

The general continued: "A retreat may sometimes be a maneuver allowing our forces to reform for a fresh combat. It must never be a flight. In every unfortunate action, there is a line which we may not cross, without being unworthy of our French blood, of our profession, of the confidence the country has placed in us. Behind this line lies the gulf in which our honor goes to wreck. This limit of extreme resistance, gentlemen, is the point at which we resolve to be killed. Die we may anywhere, but this point we may choose. On this choice may depend the issue. To make it, an officer must thoroly know the ground and the means at hand. It is by such decisions that the science and worth of leaders reveal themselves. Just see, gentlemen, what a feeling of pride we must have, when each of us feels himself capable of saying, 'Whatever betide, here I remain!'"

General de Castelnau was transfigured. We had before us, not an umpire discussing a maneuver, but an apostle preaching the sublime religion of Duty. He went on: "Let me completely set forth my ideas. To decide upon the timeliness of a noble death is an act of courage, but it is necessary to foresee its place. More yet: one must know how to die. The death of a soldier must not be a vain sacrifice, a sort of final act like that of a gladiator overthrown, and himself baring his neck for the death stroke. *When nothing but death remains, gentlemen, we must still see to it that we die in the fullness of might.*"

He remained silent a moment, and then resumed in a tone of good humor: "Pardon me this discourse. I am sure that my words are unnecessary. All of you understand your mission and are resolved to carry thru. Colonel de Cissey was right to say that he was unwilling to die. What he wants is to conquer. Death saves honor only: victory saves the country. But *the steadfast resolution to die rather than to retreat, is the measure of our moral force, of the only force that counts.* Let us cherish it, gentlemen, in our hearts, in the hearts of our men, the quality that makes heroes, and, in the hour of battle, will assure the supremacy of our arms. That is what I wanted to say to you. Suggested by a mere maneuver, I have spoken a little hotly perhaps, but so much the better."

The critique over, de Castelnau's remarks became the subject of much comment. Why not? Seldom did anyone think of the moment when France might ask the last and greatest sacrifice. The military profession had taken on, during 45 years of peace, almost the air of a bourgeois trade. Moreover, early in 1914, France thought war impossible [? Ed.] War was an anachronism. Why then be astonished that officers of much service, disillusioned, weary of garrison life, should have been astonished by General de Castelnau's words?

* * * *

Two months later, to the day almost, on this same terrain of Mailly-le-Camp, our troops broke the onset of the German invasion. At the same time about, Colonel de Cissey, victoriously defending one of the positions of the Couronné de Nancy, fell dead with a shrapnel bullet thru his heart.

Was this a mere coincidence, or must one take it as a marvelous prophecy?

[Military Metaphysics. By Poultney Bigelow. *Jour. Royal United Serv. Institution*, Feb, '17. 1500 words.]

(Dealing with the natural sympathy between Americans and British, as illustrated by the incident in Manila Bay, and with the failure of the Germans to realize what the consequences of their actions would be, as illustrated by the failure of their propaganda, and by the results of the Belgian invasion and of the Edith Cavell and *Lusitania* cases.)

[Some Impressions of the Russian Revolution. By Lieut.-Gen. Guichi Tanaka. *Kaikosha Kiji*, May, '17. 3000 words.]

The revolution which broke out recently in Russia is just like a thunderbolt from the blue sky to the ears of the people in the world. It has progressed so rapidly that none can tell to what conclusion it will come. It is a great surprise for us that the revolution was effected with such celerity, that armies took

WAR—Continued

part with the revolutionists, and above all things, that the Guards themselves opposed the Emperor. If we consider the fidelity of the Guards to the Tsar and the foundation history of Russia, no one can but be surprised at the present disturbance.

Contemplating the reason why the Russian armies were involved in the revolution, we found out that the Russian Government made a compact relation with Germany. With all the declared intention of the Government to pay respect to public opinion, it has never been put into effect, but the governmental power has all the time been misused, has suppressed the righteous indignation of the public, and it might conclude a separate peace with Germany. Such a pro-German Government would forget the object of the war, conclude a humiliating peace, and bring the priceless sacrifice made by the loyal soldiers to nothing. The armies, taking advantage of the revolution, joined the revolutionists in order to overthrow the pro-German Government.

Such is one of the reasons which is agreed to by all, but there is a still more important reason which drove the armies to take part with the revolutionists, that is, non-commissioned officers and privates were not familiar with the armies, the relation between the armies and the people was very cold. This deep rooted evil in the Russian armies was the cause of the outbreak of the present revolution. Non-commissioned officers forced officers to participate in the revolution, and soldiers had the violence to attack their commanders. These are simply the results of the explosion of the complaints they had secretly entertained against ill treatment. The fact that the armies, neglectful of their duties, joined the revolutionists should not be overlooked, but the people who compelled soldiers to side with the revolutionists are also responsible for this serious event.

In Russia the people do not pay due respect to good privates who are the important bulwark of their country, but they contemptuously look down upon them as common workers. Officers, on the other hand, treat privates like slaves and no warm feeling exists between these two classes. Accordingly, those who enter the military service for the onerous responsibility of national defense are troubled by the ill treatment of officers and ridiculed by the people so that they have no time to become familiar with the army, and at last they go so far as to dislike the army. When they return home, after the completion of the service, they naturally curse the army at the recollections of the unpleasant experiences during their military service. This idea spreads among the people with great rapidity and makes a deep gulf between the army and the people, resulting in the establishment of autocracy. All the while, religion enabled the spirit of armies not to undergo any change. But this time, stimulated by the revolution, the long entertained complaints burst out and proved to be the cause of the revolution. No wonder things went on in this way, but we feel it strange that the event did not come to pass a little earlier.

Armies must unite with people in one body, and their good or ill is usually found to be but the reflex of national morality. Especially in our country where a family is a unit, the worth of armies depends mainly on the quality of a family system. The good custom to strive for the maintenance of the good family name makes a foundation of unity, and good families are essential factors of strong armies. Accordingly, armies and people have a close relation which cannot be separated, and this point strikingly characterizes our armies. The adults in our country must be at once loyal soldiers to their Emperor and industrious citizens when at home. Armies are nothing but a large mass of these families, a company being one individual family. A company commander must treat his men with fatherly kindness and consideration, not, however, sacrificing his dignity or authority when on duty. And the men must look up to their commanders as a father, not however, becoming too familiar. By this union and harmony, armies will be able to show their real worth, and such companies will be sure to make all our armies fine and strong. The spirit ot our "Guntai-naimusko" (a book of military regulations) rests on this respect.

Command, as a rule, requires stringent rules. Officers must share the pleasures and pains with their men. They must lead their men by their own examples, thus commanding the soldiers' homage and respect. When their dignity is tempered with kindness, affinity and harmony will be firmly established, and the origin of command truly lies herein. Command will be effected to a satisfactory degree only when there is mutual understanding between officers and men, the former having dignity tempered with kindness, while the latter obey their superiors with the desire to die for those who know them well. In commands there must exist kindness, without which they are often apt to be too cold and formal, provoking the opposition of inferiors. But this kindness must be a manly kindness and not a womanly one, which, unfortunately, makes men too familiar and weak.

It cannot be said there is no officer who misuses his power and treats his men coldly. In a company which is one family, there still exists a private punishment. This is indeed a regretable thing for the good of our country. In such a case, it is entirely forgotten that the armies are to regarded like a family, and strict discipline and other small duties which are to be rather domestically carried out are altogether mixed up. Hence some thoughtless officers insist on carrying out such kind of duties by cold, mechanical rules. This is a serious blunder.

Those do not know the secret of military command who regard the "Guntai-naimusko" as a book of rules without any understanding of the pith of the book, and try to regulate the military life by this book of rules only. Outward submission and formal obedience are sure to result in the want of understanding,

the destruction of harmony, and the formation of a gulf between armies and people. The present state of affairs in Russia is of great help to understand the pith of the "Guntai-naimusko." Unless reflection is called for now, no repentance will be of any avail, and with a careful consideration, we must thoroughly understand the advantage of harmony and the secret of command. The attitude of soldiers in the Russian revolution has set a good lesson before the military educators in this country. As I was deeply moved by the reason why the revolution broke out, I call our officers' attention to this living event.

WAR COLLEGES

See
STAFF COLLEGES

WAR CORRESPONDENTS

See
PRESS CENSORSHIP

WATER SUPPLY

—Sterilization

[Measures for Disinfecting Water Pipes. By A. Stucchi, Pharmacist, 2nd Division. *Rev. del Círculo Militar,* Mar, '17. 1000 words.]

Water flowing thru closed pipes is susceptible to contamination from micro-organisms which are generated in the organic matter which accumulates in the pipes.

The mineral salts contained in the water are gradually deposited on the inner surface of the pipes, forming labyrinths of minute cells in which the water stagnates; the oxidation of the pipe also produces irregularities of the surface and obstructions which check the smooth flow of the water, causing a deposit of the organic matter carried in suspension.

This organic matter settles into the small cells formed by the mineral deposits and, sheltered from the light, furnishes a favorable condition for the culture of micro-organisms deleterious to health. As it is not possible to affect a mechanical cleaning of pipes laid underground, recourse is had to chemical agents.

The following method has been found effective. The pipes are first filled with a solution of pure sulphuric acid, 1000 grs. to a hundred litres of water; after standing a half hour the solution is flushed out with pure water. The pipes are then filled with a solution prepared by dissolving in the supply tank 500 grams of permanganate of potash for each thousand litres of water, and adding chloric acid in the presence of oxygenated water (H_2O_2) until the permanganate is decolorized. This should be allowed to stand in the pipes for about two hours and then flushed out with an abundant quantity of pure water.

The destruction of the organic matter in the pipes is effected by the free chlorine liberated in the following reaction:

$$2MnKO_4+16ClH=2ClK+2Cl_2Mn+8H_2O+5Cl_2$$

This operation should be made once a year, or twice in the case of an epidemic.

WATSON, Jonas

[Jonas Watson, First Lieutenant Colonel of the Royal Regiment of Artillery. By Lieut. Col. H. W. L. Hime (late) R. A. *Jour. Royal Artillery,* July, '16. 3000 words. 4 tables.]

Gives a brief and unconnected account of the life and services of Colonel Watson from 1693 until his death in 1741.

(Historical only.)

WEATHER

—Effect of on Military Operations

[The Weather and the War. By Robert DeC. Ward, Prof. of Climatology Harvard Univ. and Lecturer on Meterology, Mass. Inst. Tech. *Jour. Mil. Service Institution,* July-Aug, '17. 4000 words.]

Weather is an important factor in war, and has time and again influenced the result of military operations. (A number of examples cited.) It must be taken into account in planning a campaign or in preparing for a single engagement.

There are two phases of the subject—*climate* and *weather.* The former is determined by various factors and the general characteristics in any locality are known and should be provided against. The character of the climate in the proposed theater of operations therefore determines the character of the equipment. Undue heat, cold, scarcity of water, and other conditions affecting the clothing of the men and the difficulties of transportation must be guarded against by appropriate measures. On the other hand, the weather conditions at any particular time may be important as affecting military movements, artillery fire, or aerial reconnaissance. A forecast of the weather is so desirable that a military field meterological service is now an essential of modern warfare. The meteorologist must have the daily reports necessary to construct a weather map, the service being similar to but necessarily more limited than the usual peace service of this sort.

Germany made careful preparations for her forecasting service. Stations were established in Belgium as the army advanced, and the necessary observations for the forecast service made. Reports were at first sent to the Hamburg Naval Obervatory, but later the Belgian observatory at Uccle became the headquarters of the field weather stations on the western front. From this center the German forecasts have doubtless been issued. As European weather conditions, like our own (U. S.) move generally from west to east, the Germans must have been severely handicapped by the lack of reports from the British Isles and France.

England and France have doubtless co-operated in their forecast service, but the reports have of course not been made public. Their weather maps have not been accessible outside military and naval circles until their usefulness was past. On the western front, forecasts are issued daily at 9 a. m. and 9 p. m. The service is in charge of experienced and well-known men. A thoro knowledge of local conditions is necessary in local forecasting, hence the American troops must

WEATHER—Continued

rely on the French and British services for their weather forecasts. (Other articles on the subject will follow.)

WHARVES

See

DOCKS AND WHARVES

WIND

—In Aeronautics

See

AERONAUTICS—DESIGN OF AIRPLANES
AERONAUTICS—THEORY OF

WIRE, Barbed

See

BARBED WIRE ENTANGLEMENTS

WIRELESS TELEGRAPHY

See also

AERONAUTICS—USE OF WIRELESS IN
WIRELESS TELEPHONY

[Earth Connections in Wireless Telegraphy. By Capt. R. Chenevix-Trench, M.C., R.E. *Royal Engineers Journal,* May, 1917. 5500 words.]

(A technical discussion of the effect of earth connections for a wireless aerial on the efficiency of the plant in sending and receiving messages. Consideration is given the question of the insulated counterpoise as opposed to the direct earth connection and conditions stated in which each is the more effective. Methods of construction for both the conductive earth and the counterpoise are given.)

[Two Important Steps. *Canadian Military Gazette,* Aug 14, '17. 200 words.]

Wireless communication across the Atlantic has been prohibited on account of the difficulty of censoring such messages.

Panama

[The Naval Radio Stations of the Panama Canal Zone. By Lieut. R. S. Crenshaw, U. S. Navy. *Proc. U. S. Naval Institute,* July-Aug, '16. 3000 words. Photographs.]

The U. S. Navy controls the wireless situation in the Canal Zone in accordance with the recommendation of the joint Army and Navy Board, approved by the President. Among other interesting features of the recommendation of this board is a provision that no private or commercial wireless installation should be permitted in the Canal Zone, but that the department shall be opened to public service and shall transmit commercial business.

The Isthmus radio stations, the work done and the sanitary precautions to overcome malaria amongst the manning details are described.

—Aeronautical

See also

AERONAUTICS (Article: "The News of the Week")

[Radio for Aircraft. By William Dubilier. *Flying,* Sept, '17. 6000 words. Illustrated.]

Unless one has made personal observations as to the working of wireless and aircraft in this present war, it is difficult to appreciate how the art of warfare has been transformed by these two branches of science; and, in turn, modern methods of fighting have changed the art of radio and aeronautic engineering. In the early months of the war wireless stations were used for directing the artillery. The shots from the guns, however, were so constant and continuous that they caused disturbances at the atmosphere, which, in turn, seemed to effect the receptor of the wireless station, and so a continuous noise or click was heard, such as is produced by static. Immediately physicists were set to work and this objection removed. Many other problems in wireless have come up, as communication became necessary under different conditions, which enlisted almost every radio and aero worker in the fighting countries. The old type induction coils, apparatus which was placed in the junk heap ten years ago, all became very handy, due to the fact that the government was unable to obtain small sets, and that the radio companies paid so little attention to this branch.

Almost every shot fired from the artillery is directed by wireless from an airplane, which is constantly flying over the battlefield, observing the shots and immediately signalling back if they landed too far or too near. Two types of instruments are being used by the English and French armies; one having a power of between 20 and 40 watts and the other 150 watts. Recently 2-kilowatt installations have been made on the large airplanes built for England, and employed not only to signal but also to interfere with enemies' stations. The efficiency of the instrument is no longer measured by the power input to the power output. It is the distance to the weight after considering reliability of action.

The trailing wire, which is used as the aerial, is about 175 ft. long, and has a 2-lb. lead weight attached to it. The engine and all the other metallic parts on the airplane are used as the counter capacity. The Bethenod resonance alternator has large power coupled with light weight, which is made possible by the use of Bethenod's High Frequency Generator. This instrument is made in two different sizes. One weighing 35 kilos complete, about 77 lbs., has a transmission radius of 110 km., about 60 miles. The larger outfit, which weighs about 110 lbs., has a communicating radius of about 200 km., about 120 miles.

In the tests made, communication was held from an airplane to a land-station for a distance of 100 miles, with a complete installation which did not weigh more than 110 lbs., so we have here a basis upon which to work; a weight of 1 lb. for each mile of communication.

The transformer is of a close core, air-cooled type, without magnetic leakage and due to the very high frequency (1500 cycles), it is made very light and small. In the very beginning tube condensers were supplied, but now the English, French and American governments are specifying Dubilier condensers for airplane installations. The set most used by the

Allies on airplanes is one designed and built by a Mr. Rouzet. These sets are made for various powers, but the one most supplied has a capacity of 150 watts, the energy being obtained from an alternator driven by the aeroplane engine. The complete transmitter, including the self-exciting generator for 150 watts, weighs only 17 kilos, about 37½ lbs., which is less than ½ of the weight of the smallest set made in this country up to 1916. This installation utilizes a 250-cycle self-exciting alternator, driven by a belt, and is of remarkably light construction, having an armature with two commutators, one being for D.C., used for exciting. The condenser and the turning coil are very light but rigid. The resonance of the different factors is very essential, and the following points were considered in originally designing the apparatus: (1) The condenser is charged in the most favorable manner. (2) The condenser is discharged thru a suitable circuit at the most favorable moment. (3) The injurious results which accompany the discharge of a condenser, and the operation of such an instrument were reduced to a minimum. This was accomplished by the use of a synchronized spark-gap which is attached to one end of the shaft of the generator. The generator is driven at a speed of about 4500. The installations are supplied for airplanes with capacities up to 1 kw. and consist of the following parts: The generator, with a synchronized gap at the end of the shaft, a transformer, a condenser, variable inductances, accessories, such as connectors, hot wire ammeters, antennae parts, including the guide.

The possibilities of radio engineering would be greatly extended if a small, simple wireless outfit were marketed, which could be used for short distances up to 100 miles and utilizing direct current, which is available on almost every ship, and which is much easier to generate.

It has been by means of radio communication that it was possible for the artillery to break up the strong concrete trenches. The flying machines seldom stay out for longer than three hours; when they return the batteries are changed. In connection with airplane work it is necessary that automobile stations be equipped so that they can communicate with these airplanes from the field, and if necessary be quickly movable. Germany has long foreseen the possibilities of wireless communication in connection with aeronautics and for that purpose has established a chain of stations around Germany which are in constant touch with airplanes and balloons, the same plan we are now trying to carry out in this country.

Many experiments have been made to find out the best possible method of mounting aerials for radiating along surfaces. The most convenient and general all-around efficient means is to drop a trailer, and to use the rest of the metal parts of the aeroplane as the counter capacity. For airplanes it is practically impossible to receive signals, and never necessary. It is only important to send, and very rarely does an occasion occur where the operator or pilot has need or time to receive messages.

—Apparatus and Equipment

[Secret Wireless Receiving. Anon. *Journal Franklin Institute,* from *Electrical World,* vol. 68, No. 25, Dec 16, '16.]

The idea of using small concealed aerials, whether of the ordinary open or closed magnetic loop types with extremely sensitive modern radio receiving instruments, seems to have occurred to a number of experimenters. In the laboratories of the U. S. Bureau of Standards such combinations have been developed to the extent that the reception of signals is possible from the powerful continuous-wave transmitters in Germany, 4000 miles away. When the loop aerial is used, it becomes feasible to determine the direction from which the signals are coming; with two loops at right angles, and a variable phase receiving transformer, rapid measurements of bearing can be made. At Union College there has also been some work done in the development of these small receiving aerials. Messages from stations all over the United States, according to report, have been received, and there is said to be less difficulty from atmospheric and other interference than when the usual tall aerial is used. Manifestly, if small wire arrangements located within doors can be used with equal effectiveness in place of the tall structures usually resorted to, considerable economies of installation and maintenance should result.

So far as has been disclosed, there is no radical change in the indoor aerials now under test as compared with those tried in the past years. The amount of energy abstracted from the passing electromagnetic wave is small when considered in its relation to the power which would be developed by the same wave in a high antenna-wire. In spite of its feebleness, however, the received impulse can now be utilized to produce an indication, because of the availability of recently developed vacuum-tube amplifiers. Signal effects so weak as to be entirely lost by the radio receivers of five years ago can now be built up to sufficient strength for easy telegraphing.

Vacuum relays are particularly suitable for use in conjunction with small receiving aerials, for the tiny absorbing systems are not subjected to the severe atmospheric impulses which play havoc with amplifying receivers as ordinarily used. Thus it is possible to take advantage of high powers of magnification, and to secure signals of commercial intensity without too much trouble from stray interference. Directive receiving tends to minimize the harmful effects of vagrant signals, and to some degree those of atmospherics. As a whole, the indoor antenna appears to be distinctly practical; and the opportunities it offers for concealment should make its use of marked military value.

WIRELESS TELEPHONY

See also

AERONAUTICS—USE OF WIRELESS IN

[Wireless Telephony at Great Distances. Anonymous. *Schweiz. Zeit. f. Art. u. Genie,* Mar, '16. 700 words.]

WIRELESS TELEPHONY—Continued

(A transcript from *Elektrotechnik und Maschinenbau.* The article gives an account of the experiments made by the American Telephone and Telegraph Co. on Sept 29, 1915, when it succeeded in establishing wireless telephonic communications between Arlington station, near Washington, and Mare Island, near San Francisco, a distance of 4500 km. The wave length was 600 m., the current in the antennæ 100 A. The next day the operator at the Pearl Harbor station in Hawaii, 8800 km. distant, reported that he had been able to pick up the message but not very distinctly.

It is expected that after the war, steps will be taken to establish telephonic communications between America and all parts of Europe, which could easily be done with a sending radius of 9000 km.)

WOMEN SOLDIERS

[Some Women Soldiers. By Reginald F. Healy. *United Service Magazine,* Oct, '16. 2000 words.]

(Stories of women soldiers, including Christian Kavanagh, Hannah Snell, and Phoebe Hessel.)

[Women Warriors in India. By Colonel R. G. Burton. *United Service Magazine,* Dec, '16. 3600 words.]
(Historical.)

WOUNDED

See also
Red Cross Society
Surgery, Military
Wounds

—Appliances for

[Paper Legs for the Disabled French "Poilus." *Scientific American,* Apr 14, '17. 120 words.]

Artificial legs of a temporary nature, made from papier maché and costing not over 75 cents each, are now being supplied to disabled French soldiers in Paris hospitals. They can be used a fortnight after amputation, require a day to dry and set, and will last from six months to a year. They obviate the necessity for crutches while the patient is convalescing.

—Instruction and Training of

[Vocational Training for Disabled Canadian Soldiers. *Modern Hospital,* June, '17. 600 words.]

Early in the war the Canadian Government appointed a commission to look after various questions connected with the care and employment of disabled soldiers. Early in 1916, it was decided to provide occupational work for those undergoing treatment at convalescent hospitals for disciplinary and therapeutic reasons and because it would increase in many cases the earning power of the patient. The vocational training has included general subjects, business courses, arts and crafts, and various kinds of outdoor work, such as gardening and poultry keeping.

The problem of re-education of the seriously disabled has also been taken up vigorously. A careful personal survey is made of each man's case by a board of three persons known as a Disabled Soldiers' Training Board, one of which is a medical man, one a vocational counsellor, and a layman chosen to represent the local unofficial viewpoint. The educational and industrial history of the patient, his habits, tastes, and desires for the future are ascertained ,and a recommendation made. If this recommendation is accepted, the disabled man enters upon a course of training at government expense. During this period of training and for one month after its completion, the man and his dependents are maintained by the government. Two serious special problems are the tubercular patients and those suffering from shell shock. The former are given occupational work with good results. The treatment of shell shock is a most difficult question to handle.

[Vocational Training of Returned Soldiers. *Canadian Military Gazette,* July 10, '17. 800 words.]

The work is under the Military Hospitals Commission. Some disabled soldiers do not desire to earn their own living, and others are afraid that any money earned by them will result in a reduction of pensions. This latter has been provided against by law.

Each case is investigated separately to determine the direction which the re-education shall take, decision being based upon medical, technical, economic, and personal factors. Training is carried on during convalescence. The object is primarily curative and secondarily for commercial value in after life. Many men are thus prepared for better positions than they were able to fill before enlistment.

The numbers enrolled in classes in convalescent hospitals to May 1, 1917, was 1505, and the number now under instruction is 536. Re-educational courses have been granted to 587 men up to June 28, 1917.

—Treatment of

[Precision in the Treatment of Wounds. *Scientific American,* Feb 3, '17. 400 words.]

Dr. Alexis Carrel has perfected a new method of sterilizing wounds which eliminates the vexed question as to when all danger of suppuration is so remote that a wound may be closed. He has devised a tube system by which thoro irrigation of the deepest wound is made easy. The trunk tube has a number of branches, closed at the ends, but perforated along their lengths. When these are arranged in the wound, the operator, by pressing the bulb which connects the tube with the source of supply, forces the antiseptic fluid into every part of the affected tissue. The solution is that devised by Dakin and consists of a one-half per cent. solution of hypochlorite of soda. This method is so reliable that frequently a surgeon will order a wound closed without inspecting it, when the daily microscope count of germs shows that it is safe to close the wound.

[Sugar Cured Wounds. *Independent,* Feb 5, '17. 150 words.]

Dr. Alexis Carrel in France has shown how to prepare a cheap and very effective antiseptic from sodium hypochlorite and boric acid. In Germany, Dr. Erich Meyer has gotten good results by dressing wounds with ordinary granulated sugar after washing them out.

The wound is covered with a compress in which the sugar is renewed every second or third day.

[Electrical Treatment of the Wounded. *Scientific American,* Feb 10, '17. 200 words.]

Dr. W. J. Turrell, of Oxford, England, describes the treatment of unclean wounds by ionization, produced either by the application of salt solutions traversed by an electric current, or by means of ultra-violet rays. The application of mild electric shock, so successful in some cases of nerve shock, must be made with discretion in case of "shell shock," as sometimes the patient is not benefited and, indeed, exhibits "electrophobia."

WOUNDS

See
Surgery—Military
Wounded

WYTSCHAETE RIDGE, Battle of

[Wytschaete Ridge. By Hilaire Belloc. *Land and Water,* June 14, '17. 3100 words. 1 sketch.]

General Plumer's second army on June 7th achieved the greatest individual success of the war upon the West since that war became one of seige operations.

The operation may best be described as the seizing of "White-Sheet" Ridge. The great value of this successful operation is not that it relieves the salient of Ypres, tho this fact should not be neglected, but that it gives complete observation over all the country which flanks Lille to the north. An enemy retirement in the future could hardly pivot upon any other point than Lille. Therefore, to hold Lille to the last is essential to him; but the flank guard of Lille, on the north, so far as observation is concerned, was the Wytschaete Ridge. In character the operation was similar to the two actions near Verdun in October and December, 1916.

There was the prolonged rehearsal, the use of models, the concentration of bombardment upon a comparatively narrow front, the large number of prisoners and the astonishingly light casualty list, also the two French actions were fought, as was this one, mainly for observation.

As a result of this and former actions in the Artois eight weeks for about one-third of a million in enemy and Champagne the Allies have accounted in some casualties, of which about 70,000 are prisoners, In no single case during the successive phases of the Western offensive has the enemy's counter-effort permanently succeeded. The operation is universally admitted in private and public accounts to be the most successful of its kind.

The accurate timing of every movement worked better than ever before. Confusion usually comes, not in arriving at the first objectives, but in the next steps to the second and third. In this case all three steps went exactly according to the time-table.

The air service was excellent; the co-operation between the various arms reached a perfection never before attained. Incidentally, the battle as a whole emphasizes the now decisive importance of the air, that is of a permanent superiority in the air maintained thruout the course of a prolonged preparation and, as it were, acknowledged by the enemy.

Y. M. C. A.

See also
Motor transport—For soldiers on leave

ZEPPELIN, Count Ferdinand von

[The Passing Away of Count Ferdinand von Zeppelin. *Scientific American,* Mar 17, '17. 200 words.]

Count Zeppelin died on Mar 8 of pneumonia. He was born in 1838 in Constance, Baden. He spent the greater part of his life in the German army. He was with the Union armies as military attaché in 1863 during our Civil War, at which time he made his first balloon ascent. In 1892 he retired from military life and began his airship studies. Altho Zeppelin encountered a series of bitter disappointments, he stuck to his task with a determination that has won the admiration of the world. Airship after airship which he constructed was destroyed; his fortune was wiped out; yet, aided by the German Emperor and financed by the German public, he at last succeeded in developing his airship to a comparatively high state of perfection. But the fact remains that the Zeppelins have never achieved the military triumphs that were expected of them by their inventor.

"ZEPPELINS"

See
Aeronautics—Use of in European war
Dirigibles
Dirigibles—Germany
Dirigibles—Rigid